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Marguerite K Kennedy
MARGUERITE K. KENNEDY
Chief, Archives Branch
The Albert F. Simpson Historical
Research Center

Billie H. Hix
BILLIE H. HIX
Chief, Technical Systems Branch
The Albert F. Simpson Historical
Research Center

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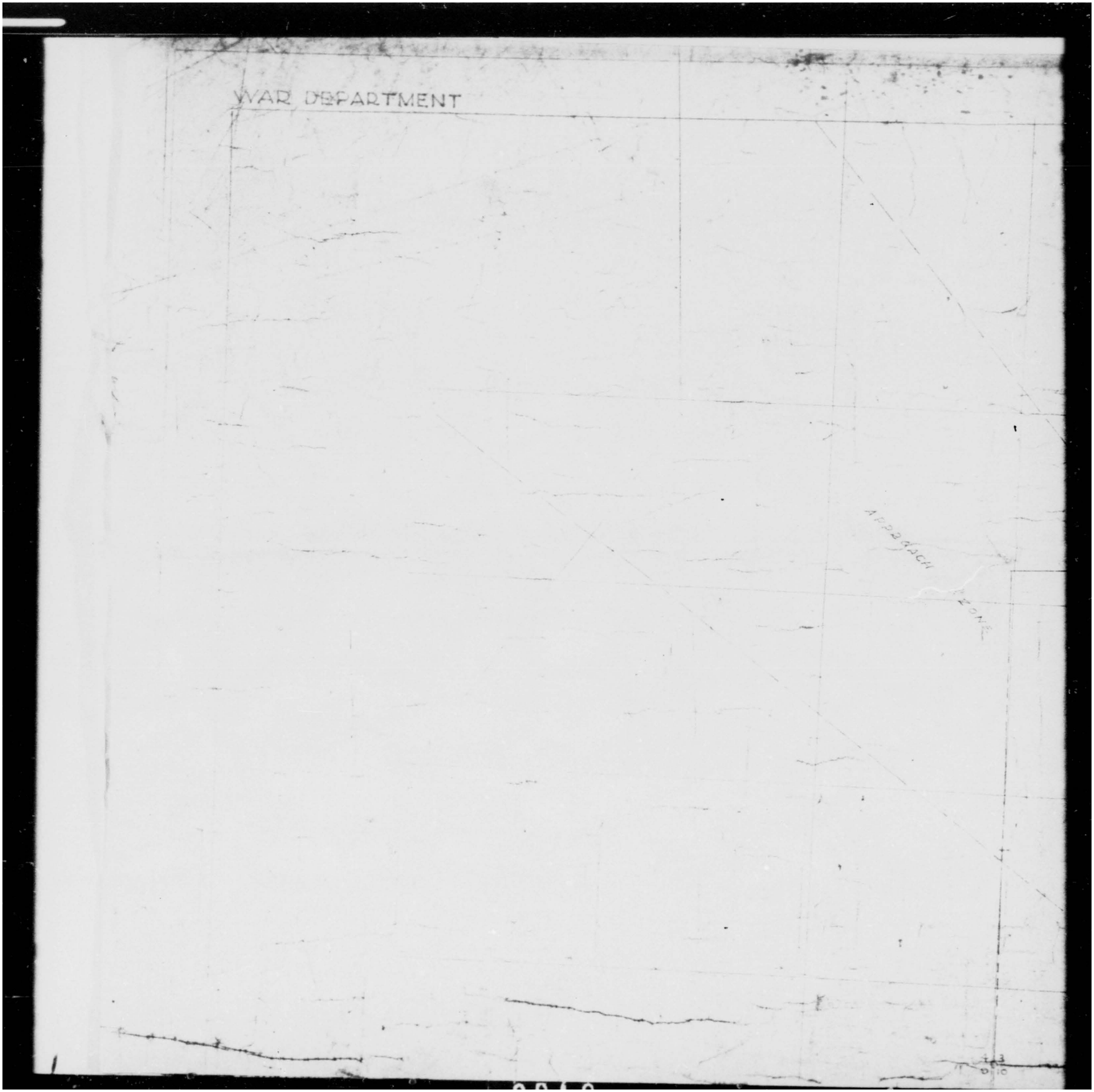

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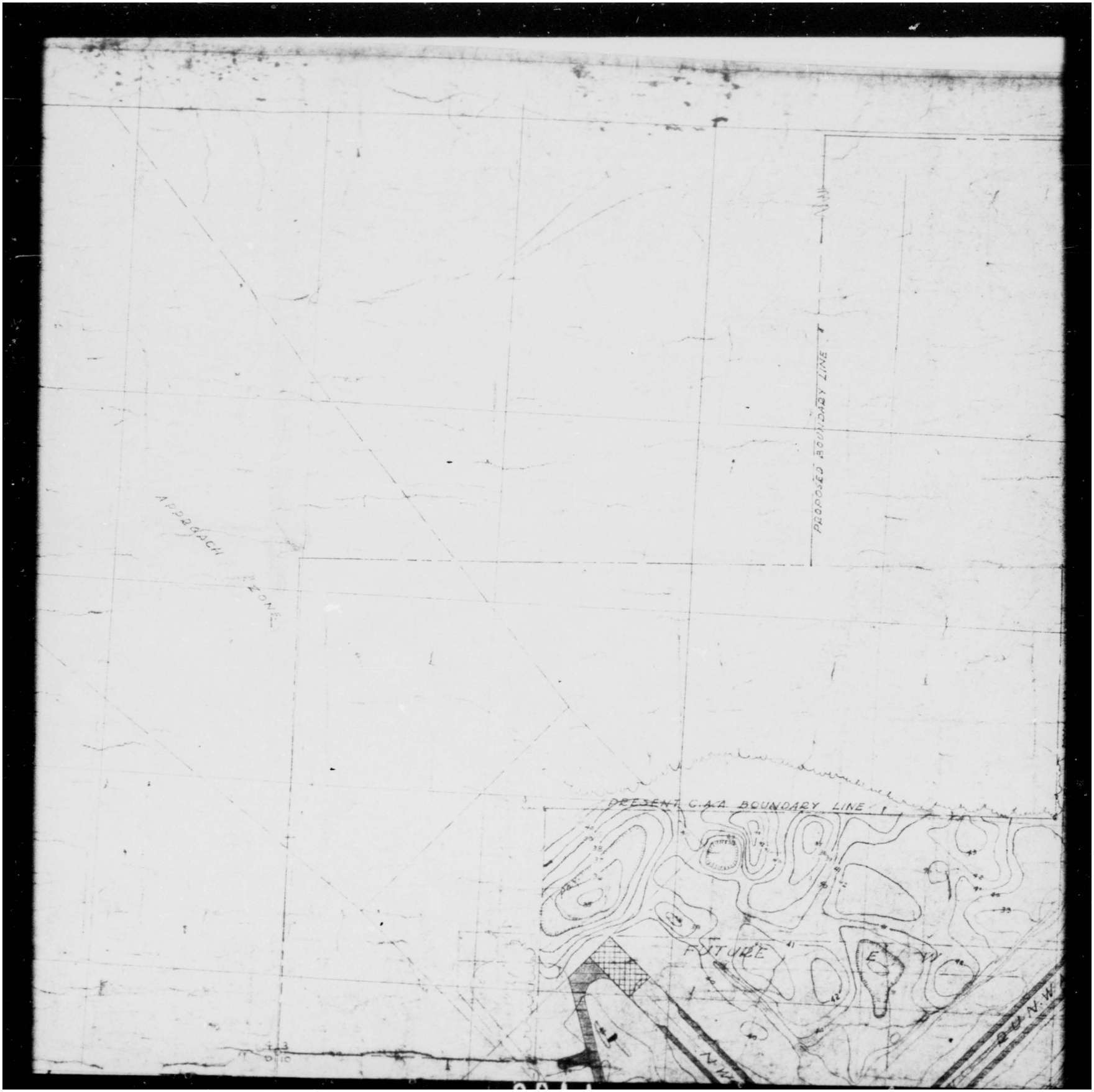

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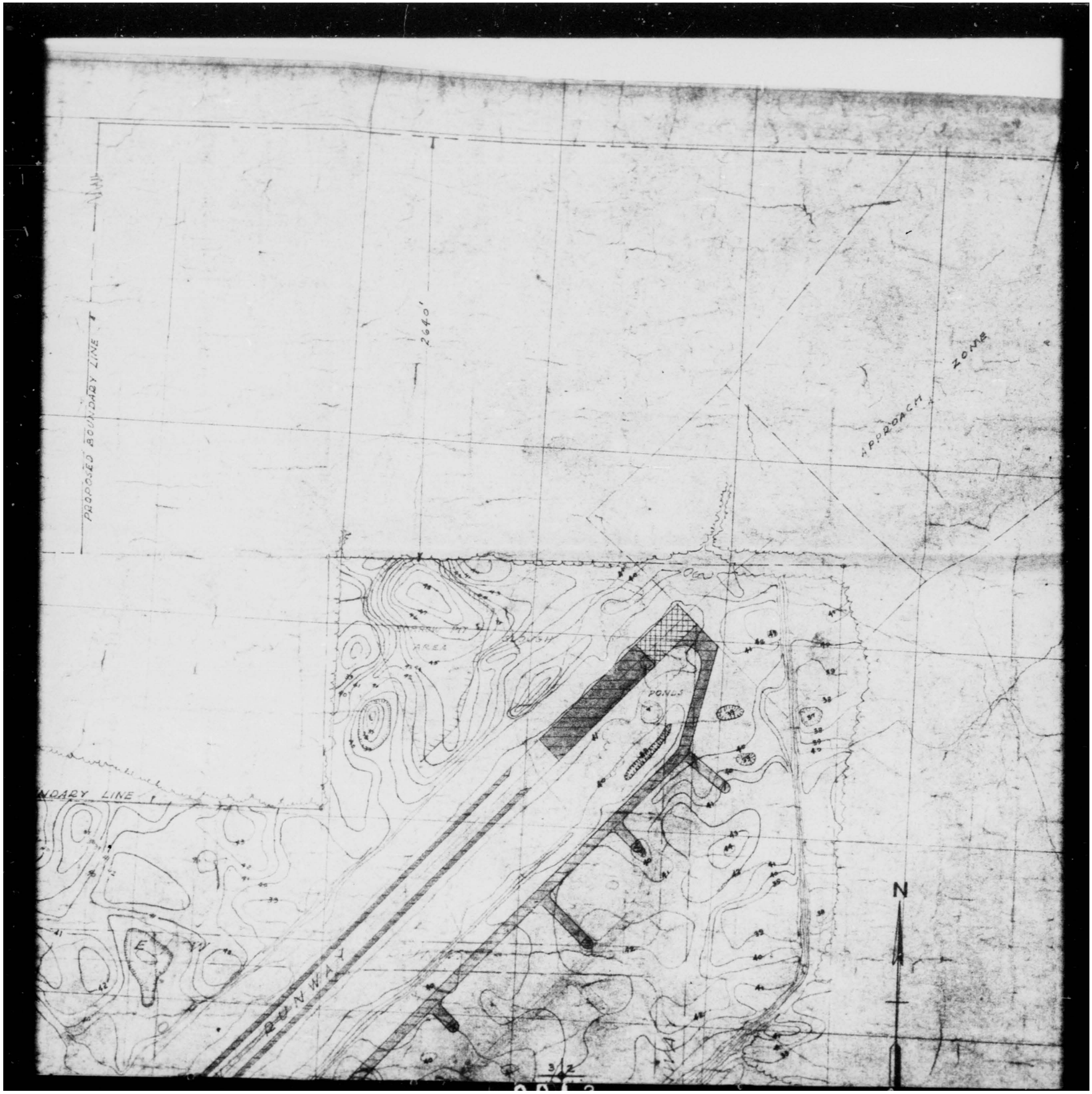

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CORPS OF ENGINEERS, U.S. ARMY

EXISTING BUILDINGS- CCC CAMP

ITEM	SIZE	NO. OF MEN	NO. OF UNITS	DESIGNATION	PROPOSED USE
BARRACKS, E.M.	20×141	40	15	B-15	BARRACKS
RECREATION HALL	20×101	32	1	B-16	BARRACKS
MESS, E.M.	20×141 20×40 wing		1	M	MESS
MESS KIT LAUNDRY	16×21		1	MKL	
HOSPITAL	20×31		1	HOS	
WOOD SHOP	20×131		1	OFF.	U.S.E.D OFFICE
OFFICE & SUPPLY	20×91	28	1	B-17	BARRACKS
OFFICE & SUPPLY	20×72		1	O&S	OFFICE & SUPPLY
OFFICERS' QTRS.	20×41		1	B-18	BARRACKS
TECH. SGT. QTRS.	20×81	26	1	B-19	BARRACKS
MAINTENANCE SHOP	31×31		1	MS	
BLACKSMITH SHOP	20×31		1	BLS	
OIL HOUSE	10×26		1	OH	
PUMP HOUSE	10½×11		1	PH	
GARAGES	205×60		4	GAR	2 GAR & 2 STORE HSES
LATRINE & BATH	20×56		1	L-21	LATRINE & BATH

Modify existing bldgs. to house E.M. facilities

BUILDING SCHEDULE

DIR. NO. A-4135, DIST. NO. A317, JOB NO. CROSS CITY A-(2-1)

ITEM	TYPE	NO. OF MEN	NO. OF UNITS	DESIGNATION
OFFICERS' QUARTERS	OQ-AT	16	11	OQ-1
LAVATORY, OFF.	L-50-T	40	4	OL-2
RECREATION BLDG.	TRB-2		1	OR-3
MESS, OFFICERS'	MHT		1	OM-4
ADMIN. & OPERATIONS BLDG	TA-6		1	A & O-5
LINK TRAINER BLDG.	SH-3		1	LT-6
ASSEMBLY & SCHOOL BLDG.			0	7
POST EXCHANGE	TA-6		1	PX-8
DISPENSARY	MD2		1	DIS-9
FLAG POLE			0	NOT REQUIRED
BARRACKS	C.C.C.	40	4	B-20
LATRINE & BATH	C.C.C.		1	L-22

* BUILDINGS TO BE REMOVED FROM OTTER CREEK CCC CAMP & REBUILT AT THIS SITE AS PER DIRECTIVE

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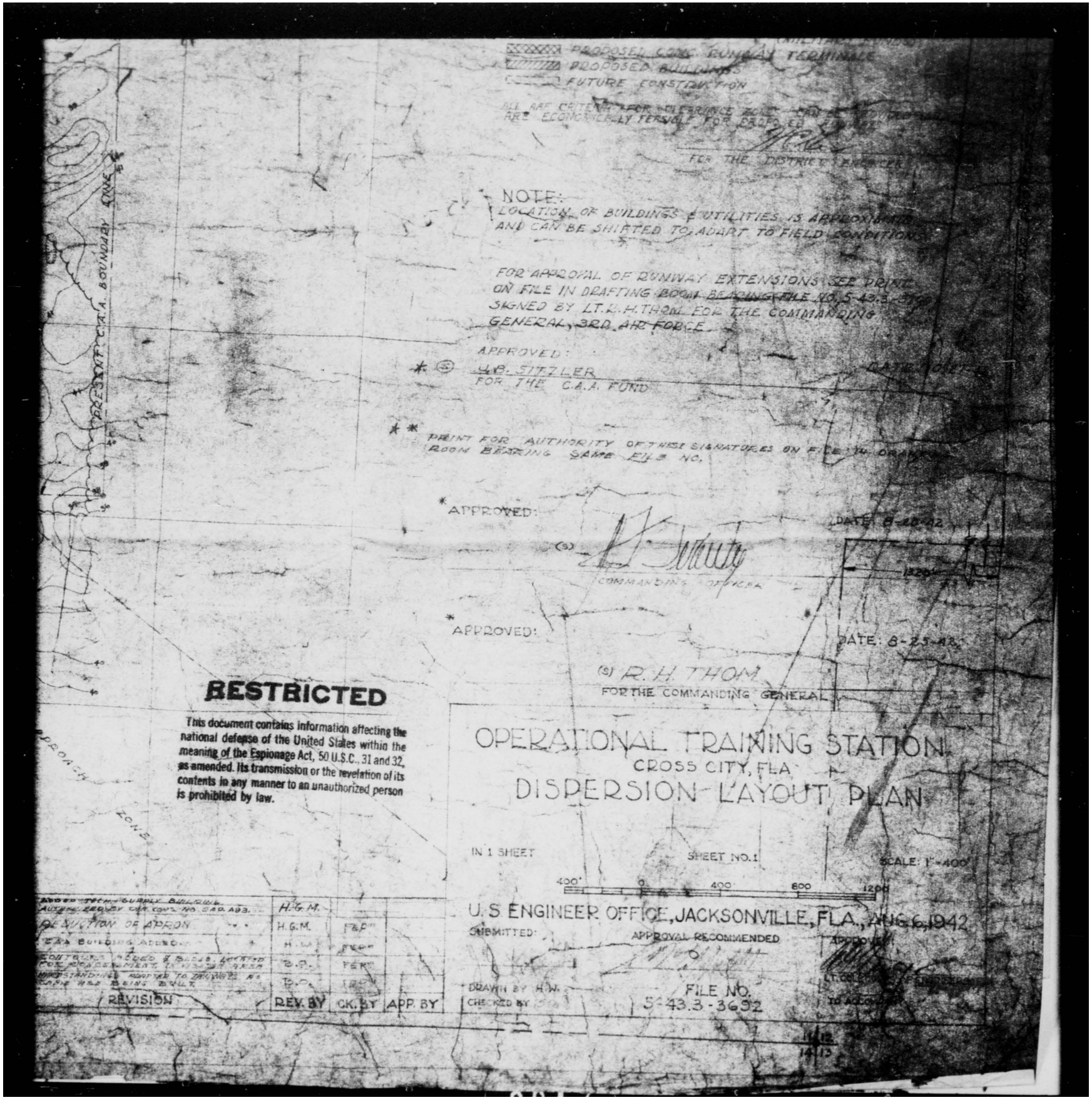

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Aviation Cadet Qualification
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Eliminees

Subject: Aviation Cadets for Bombardier and Navigation Training.

1. Train. Asst. for 1942 Div. Pers. & 1/18 SS-51/ Train. az THRU Mil. Pers. & Med: Div:-

1. Military Personnel informs this division that eliminated flying cadets are now being sent to the training centers for entrance into the bombardier and navigation courses. New aviation cadet selection policy involves a screening at the training centers to determine if a man is to be selected for pilot, bombardier or navigation training. It is evident that those cadets who have already been eliminated from pilot training are not susceptible to this screening test. It is also evident that these eliminated flying cadets are not desirable material for bombardiers and navigators. The confusion from this system and the chances that exist that students will be assigned to bombardier and navigation training who are not properly qualified, should be corrected.

2. It is recommended that consideration be given to revising existing policy so that any flying cadet eliminated from any phase of flying training will not be considered for any other type of flying training. By doing this the type of personnel assigned to combat crews will be improved and the chances of successful application of combatment aviation will be decidedly increased. These flying cadets so eliminated from flying training can be salvaged for different types of ground training now available to these men

3. A screening test for aviation cadets which will select pilots, navigators and bombardiers provides the complete solution of supplying the proper men to be trained under each category.

H.A.J.
Lieut. Colonel, A.C.
Chief, Training Division.

2. Mil. Pers. Asst. for 1942 Pers. & 1/28 Trng. THRU Med. Div.

1. The Military Personnel Division does not concur in the statement included in paragraph one that eliminated flying cadets are not desirable material for bombardier or navigation training. Records in this office indicate that such eliminated cadets who have been recommended and accepted for bombardier or

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Subject: Aviation Cadets for Bombardier and Navigation Training.

2. Mil. Pers. Asst. for 1942 Trng. THRU 1/28 Med. Div.

navigation training are as successful in completing the course of instruction as those civilians who have had no previous training, and further that in many cases such eliminated cadets have been at the top of their class, even proving so valuable as to be assigned as instructors upon receiving their commissions. Class 42-2, navigators, graduated January 31st, 1942, included sixty-nine cadets of which twenty-six are eliminated pilots and forty-three are civilians. This class was picked arbitrarily merely because it is the most recent graduating class, and is believed typical of all classes. Of the twenty-six eliminated pilots, upon their completion of training as navigators, thirteen were requested for further duty as instructors while only nineteen of the forty-three civilians were recommended for such duty. Only one former Aviation Cadet pilot was eliminated from the course of training as navigator. This is believed significant in that those men recommended for assignment as instructors upon completion of their course of training are hand picked on a basis of superior demonstration of proficiency and ability while undergoing training.

2. It is therefore suggested that the following policy be adopted effective this date:

a. Cadets eliminated from pilot training for basic flying deficiency who did not demonstrate fear of flying, apprehension, or tenseness while in the air, and who desire and are recommended for Air Crew non-pilot training as bombardier or navigator will not be discharged from the service but will be given the new screening test. These screening tests may be obtained from appropriate Training Center or Corps Area Headquarters. All training detachments and flying schools will be authorized to transfer direct to the closest replacement center for psychological processing and selection for specific air crew non-pilot duty

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COPY

Subject: Aviation Cadets for Bombardier and Navigation Training.

2. Mil. Pers. Asst. 1942 for 1.28 Trng. THRU Med. Div.

those cadets who successfully pass the screening test. Cadets who fail to pass the screening test or are otherwise disqualified for further training will, if originally enlisted as Aviation Cadets from civilian status, be discharged for the convenience of the government. They will be offered enlistment in the Air Corps in the grade of Private. If they refuse enlistment, they will be warned to register with their local draft board within five days after date of discharge.

b. Former Aviation Cadets who entered training prior to January 7th, 1942, who were eliminated from pilot training and discharged, may apply for further Air Crew non-pilot training under the new procurement system. All such applicants will be required to successfully pass the screening test and will be required to undergo psychological processing and selection upon arrival at the Air Corps Replacement Center. In order to be eligible, these eliminated discharged cadets must not have failed any of their ground school subjects while undergoing pilot training, must not have demonstrated traits of fear, tenseness, nervousness, or apprehension in the air, and must have been recommended for further training by their training center commander. Aviation Cadet Examining Boards will be directed to obtain this information from this office before administering the screening tests.

3. If the policies outlined in paragraph 2 are adopted, all applicants arriving at the replacement centers for Air Crew non-pilot training, whether still in the service or on civilian status, can be processed in a standard manner by use of the psychological processing test already in use at all such centers.

4. This Division concurs in paragraph 3 and further believes that the screening test, when used as outlined above, will select navigators and bombardiers from among the ranks of eliminated pilots who will prove as satisfactory material for this type of training as those civilians who

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Subject: Aviation Cadets for Bombardier and Navigation Training.

2. Mil. Pers. Asst. for Pers.& Trng. THRU Med. Div. 1942 1/28 are selected by the same process

R.E.F.
Chief, Military Personnel Division.
(P-3) HCC:EAL

3. Med. Div. Asst. For Pers. 1942 2/3

1. There is no objection to the process of selvaging eliminated Aviation Cadets for additional Air Crew training as outlined in Item 2, and this policy is in keeping with the desire of the Commanding General of the Army Air Forces. However, various members of the staff in the Training Division have indicated very strongly their desire to discontinue such a procedure and utilize for Air Crew training only those Aviation Cadets who are selected by the present psychological classification and selection process now in force at the replacement centers (Air Crew).

2. The process of psychological selection and classification should produce a more orderly flow of qualified personnel which would be available for training at the various specialized schools (Air Crew).

H.S.C., Chf. Prof. Serv. Sec., Med. Div.

4. Asst. C.G., AC for Pers. 1942 2/7

1. Forwarded for further comment, if desired, in view of items 2 and 3.

J.M.B.
Lt. Colonel, Air Corps
Assistant for Personnel

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(SOURCE - PAGE NO.)	(SUBJECT - SUBDIVISION)	(EXACT NATURE OF WORK)
(FILE NOS.)		

(NOTE TAKER)

Supporting document with ~~report~~ ~~study~~ "Historical Data on Assignment of Non-Pilot Aircrew Trainees to and from Classification, Preflight and Specialized Schools of Army Air Forces Training Command," Historical Section, A-2, AFTRC, 11 February 1944, in files of Historical Section, A-2, AFTRC.

(COMMENTS - QUERIES & CROSS REFERENCES)

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Avignon and Adjacent Airdromes

AC/AS, Intelligence, Operational Division, Target Branch — Date Jun 13 1944

AC/AS, Plans

Comment No. 1
ACC/Mar/6724

1. It is requested that information be furnished this office as a matter of urgency in connection with a current study:

a. Size, surrounding terrain and type of runway construction of the following airdromes in the Rhone River Valley:

(1) Monteliar - Acone
(2) Pierrelatte
(3) Orange - Plan de Dieu
(4) Caritat
(5) Avignon - Pujaut
(6) Avignon - Chateau Blanc
(7) Nimes - Courbessac

b. Geographical features and lines of communications in the general Avignon area.

c. German Air Force strength and disposition in this area.

/S/ JOE L. LOUTZENHEISER
Colonel, GSC
Chief, Operational Plans Division

TO: AC/AS, Plans

FROM: AC/AS, Intelligence

DATE

COMMENT NO. 2
DLS/dak/ro/72510

1. Information as requested in Comment No. 1 is inclosed as Tabs "A", "B" and "C".

3 Incls.
Tab "A" - w/Original only.
Tab "B"
Tab "C"

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Geographical Features and Lines of Communications in the General Avignon Area

GENERAL

Avignon, which is located on the East bank of the Rhone River and 50 miles from the mouth of that river, is the principal city in a broad fertile plain which stretches from Tarascon, 25 miles to the South of Avignon to Orange on the North. The two largest towns in the area - Avignon and Orange - are built on isolated hills rising from the plain. Farms and villages are scattered over the river flats. Avignon is an important rail and road center at the junction of the North-South routes along the Rhone River and the East-West routes along the Mediterranean.

GEOGRAPHIC FEATURES

Terrain

The Avignon-Orange plain extending North and East of Tarascon is broken only by two small but sharp North-South ridges rising to heights of 200-500 feet. The first ridge is between Tarascon and the Durance River. The second ridge reaches from St. Remy to Orange in an arch five miles East of Avignon and paralleling the Rhone. This ridge is broken into three parts by the Durance and Ouvreze Rivers. North of Avignon the plain is roughly 12 miles wide.

On the West of Avignon the land rises sharply from the narrow shore of the Rhone to the Cevennes and Ardeche Hills. The West shore of the Rhone is seldom more than two miles wide and at points the rugged and forested hills come practically to the water's edge.

The Eastern slopes of the valley in the vicinity of Avignon are more gentle and are more broken by stream valleys. The sharp Alpine foothills rise to heights exceeding 4,000 feet within 20 miles to the East and North-East of Avignon. These have a covering of scrub trees.

Along the Rhone are belts of meadows, truck gardens or wasteland. These are flooded in the Spring and early Summer. Around Avignon there is extensive truck gardening. The gardens are hedged and lined with poplar trees to protect the gardens from the cold Alpine winds. To the East of the second ridge and in the vicinity of Orange the plain is cultivated for vines, olives, fruit trees, and some cereals. On the higher terraces are wastelands of scrub trees.

Water

The Rhone River and the Durance River which flows into the Rhone just below Avignon are wide (over 1,000 feet). The Rhone has a minimum depth in winter of 4 feet 5 inches. High water occurs during the summer due to melting snow in the Alps. The water level of the Rhone is relatively

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stable year around, but the Durance may narrow considerably during the dry season. Tributaries to the Rhone on the West are subject to flash floods originating in the steep hillsides.

Considerations Concerning Cross-Country Movement

Soils - The river flats are wet in the Spring and Summer though the soils themselves are not heavy. The soils over the alluvial terraces are dry and firm.

Vegetation - There is little natural vegetation except on parts of the hills rising from the plain and along parts of main ridges. The extensive orchards and vineyards however are hindrances to movement as are hedgerows and treerows in the more intensively cultivated parts.

Steep Slopes - Over most of the plain the only steep slopes are occasional short ones between the alluvial terrace regions. In some places these terraces are separated by a steep slope up to 30 feet high. The hills rising in the middle of the plain and the edges of the Cevennes and Ardeche Hills usually have steep slopes.

Water - The Rhone-Durance Rivers are the principal obstacles to movements. Other water obstacles in the area are the lesser tributaries of the Rhone and drainage and irrigation canals.

COMMUNICATIONS

The Avignon area has one of the best rail and road networks in southern France. The principal North-South and East-West railroad and highway routes in Southern France pass through this area. Alternate coastal and North-South routes are available but have far less capacity. The Rhone River is navigable but water traffic on it through the Avignon area is not heavy. Shifting sand bars above Tarascon, just South of Avignon, make it necessary that services of expert pilots be obtained for safe navigation.

Roads

Two main through highway routes cross the Rhone South of Avignon. Both roads carry two-way traffic but are estimated to have a load limit of 25 tons. Highways from Nimes to Avignon and Marseilles to Avignon which form roughly a through east-west route have a load limit of 40 tons. From Lyon, in the North, to Avignon a two-way highway follows each bank of the Rhone. The Eastern bank road will carry 40 ton loads and the Western bank road 25 tons. Highways paralleling these from Grenoble to Marseilles and from Clermont-Ferrand to Nimes have steep grades and although two-way roads have load limits of only 18 tons. In addition to the main through routes, there are many minor roads of local importance only.

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Railroads

There is a double track East-West railroad line passing through Avignon. It has far greater capacity than the combined capacity of two single-tracked railroad lines extending East and West between Avignon and the sea. The two principal North-South railroad lines between the Mediterranean and Paris follow the Rhone River through Avignon. The railroad on the East bank of the Rhone is double tracked through Avignon and has a capacity of approximately 70 trains per day in each direction and a load capacity of 550 tons per train. On the West bank the line is also double tracked, but has a capacity of 48 trains per day in each direction and a train load of 450 tons. It is apparent therefore that the Avignon area is very important for North-South and East-West railroad traffic. There are two North-South parallel lines East and West of the Rhone valley railroads but these have single tracked sections which reduces their capacity to 16 and 20 trains per day respectively. Moreover, the steep mountains that these lines must traverse reduce the train load capacity to 350 ton.

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WAR DEPARTMENT
HEADQUARTERS OF THE ARMY AIR FORCES
WASHINGTON

AFIAN-EU

TAB "C"

~~MEMORANDUM~~ FOR: Colonel DeWitt L. Sage

~~SUBJECT~~: German Air Force Strength and Disposition in the Rhone River Valley Area.

1. G.A.F. initial establishment strength on 9 June in the Rhone River Valley Area was:

Long Range Bombers	93
Long Range Reconnaissance	9
Ground Attack & Anti-Tank	9
Special Reconnaissance	3
Single-Engine Fighters	0*
Twin-Engine Fighters	0
Tactical Reconnaissance	9
Coastal	9
Total	132 Aircraft

* Although there are no first-line single-engine fighters in this area, 40 R.T.U. single-engine fighters are disposed here.

2. Actual strength is estimated as being approximately the same as given in the table in paragraph 1.

3. Outside of a decrease of 30 long range bombers and 9 twin-engine fighters, there has been no change in strength in this area since D-Day. However, the long range bombers undoubtedly are being employed in ~~this~~ operation Overlord

Norman E. Hansen
NORMAN E. HANSEN
Captain, Air Corps

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APPENDIX 2.

ANSWERS OF GENERAL CHRISTIAN TO QUESTIONS
OF AC/AS-2, HEADQUARTERS, ARMY AIR FORCES
(20 SEPTEMBER, 1948)

PREPATORY NOTE: Major General Christian was selected specially to answer the questions proposed by AC/AS-2, Headquarters Army Air Forces, because of his exceptional qualifications. He is a General Staff Air Officer who has served in important positions both with OKW and OKL. Prior to the War he attended the LAF Staff College, and served in the Operations Section of the General Staff of OKL. At the outbreak of war he was Adjutant to the Chief of the General Staff, and in March 1940 was sent for field experience to Fliegercorps X, and subsequently became Commander of a Torpedo Bomber Group in 30-40. From January 1941 to August 1943 he was the General Staff Officer representing OKL with the Chief of the OKW Operations Staff. As indicated below the normal functions of the General Staff of OKW were actually performed in a large part by the Operations Staff. General Christian returned to OKL in September 1943, and served there in various capacities until April 1945. During this time he became chief of the LAF Operations Staff, and as such was Deputy to General Koller, Chief of the German Air Staff. At the very end of the war, General Christian became head of GAF Operations Staff, North, and was thus in charge of final Luftwaffe Operations in northern Germany.

PRELIMINARY COMMENTS BY GENERAL CHRISTIAN:

The statements given below have been made from memory and without the material necessary for a more detailed explanation. They are therefore incomplete in regard to certain details, but accurate in regard to the major issues involved. The biographical details of the persons mentioned are not familiar to the author and must be supplemented from other sources. The answers, especially for questions 7, 10, 11, 12, must be considered as being based on the author's personal attitude to the subjects in question.

QUESTION 1: The composition of the OKW and the names (with short biographies) of its more important members in March 1935, i.e. at the time that the establishment of the LAF was made public.

ANSWER: The OKW only came into existence in February 1938 and was created from what had been the War Department. In 1935 the composition of the Armed Forces in the highest positions was as follows:

Supreme Commander of the Armed Forces: Adolf Hitler. After the death of the President von Hindenburg, the highest authority over the Armed Forces was invested in the person of the Führer,

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and all German soldiers had to give an oath of allegiance to Adolf Hitler. Under him, the following were responsible for the direction of the Armed Forces:

The Secretary of War and the Commander in Chief of the Armed Forces:

General von Blomberg.

Subordinate to him in every respect were the following:

Commander in Chief of the Army:

General of Artillery von Fritsch.

Commander in Chief of the Navy:

Admiral of the Fleet Raeder.

Commander in Chief of the Air Force:

Air Marshal Goering.

The latter was at the same time R. d.L. (Minister for Air) and in this capacity he was independent. With the Supreme Commander of the Armed Forces was the Führer's Adjutants Office of the Armed Forces (Adjutantur der Wehrmacht beim FÜHRER). It consisted of one army officer (who also held the post of Chief Adjutant), one naval, and one air force officer. The Chief Adjutant was at the same time liaison officer for the Commander in chief of the Armed Forces. A similar Aijutant's Office existed for the Commander in Chief of the Armed Forces.

The War Department itself was composed of members of the three services. It consisted fundamentally of 4 major offices and several independent departments:

Armed Forces Operations Office:

Major General Keitel

Office of Foreign Relations and Security:

Captain (Navy) Canaris

General Office of the Armed Forces:

Colonel Reinicke

Office of War Economy and Armament:

Major General Becker

Central Department:

For the personnel matters of the War Department, decorations, questions of honor, etc.

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Legal Department:

For questions connected with military law, court martial, disciplinary regulations, etc.

Administrative Department:

For fiscal and general administrative matters connected with the Armed Forces.

There were additional departments dealing with less important matters. The most important office was the Armed Forces Operations Office with the Defense Department:

Colonel Jodl

With the Group Director for the Army:

Major Zeitzler

With the Group Director for the Navy:

Lieutenant Commander Krancke

With the Group Director for the GAF:

Major Bernicke.

and a mixed organizational group.

QUESTION 2: The powers of the OKW with special reference to the air force, the army, and the navy in March 1935.

ANSWER: As immediate superior, the Commander in Chief of the Armed Forces had full authority over all departments of the services, except where Adolf Hitler, as Supreme Commander, himself claimed authority. The Commander in Chief of the Armed Forces was a member of the government and of the cabinet council. A special position was occupied by the Commander in Chief of the GAF, since as R.M.L. (Minister for Air) he also belonged to the cabinet and therefore had a voice where final decisions were concerned.

The War Department dealt with all important matters of common concern to all the services, and its directions, orders, regulations, and rules were binding in all such matters. The main functions of the Armed Forces Operations Office were as follows:

Directions for defense.

Table of Organization orders for the major units within the scope of re-armament.

Directives for mobilization.

Clarification of the co-operation between the three services, maneuver, etc.

The main functions of the Office of Foreign Relations and Security were as follows:

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Foreign information service.

Liaison with the State Department.

Security.

Counter-Espionage, etc.

The main functions of the General Office of the Armed Forces were as follows:

General regulations for the Armed Forces, i.e. unit regulations, uniform regulations, military courtesy, etc.

Position of the Armed Forces in the state and similar matters.

The main functions of the Office of War Economy and Armament were as follows:

The fundamental questions of armament and economic mobilization.

Apart from this the Department of War dealt automatically with all questions of military legislation, fiscal matters, military and naval administration and jurisdiction. Less important matters could be automatically referred to a branch of the Armed Forces.

The RLM (German Air Ministry) dealt independently with civil aviation, including weather service and civilian air raid protection.

QUESTION 3: The decrees of February 1938 making Hitler Supreme Commander and modifying the power of the OKW over the GAF, Army and Navy.

ANSWER: With the withdrawal of Field Marshal von Blomberg from the position of Commander in Chief of the Armed Forces, Hitler's assumption of immediate authority over the Armed Forces began. While previously he had remained in the background, appearing only at manoeuvers, parades, and reviews, he now took authoritative part in the administration of the Armed Forces. The position of Commander in Chief of the Armed Forces was not filled by another, but was taken over by Hitler. In this position he directly subordinated to himself the Commander in Chief of the Services.

The Department of War was renamed OKW, and General von Keitel, as Chief of the OKW, was put at its head. He now held the position of Chief of General Staff, on all questions concerning the Armed Forces, to the Supreme Commander of the Armed Forces himself, and at the same time he fulfilled the former ministerial functions of the War Department. In addition to von Kietel, all three commanders in chief of the services now became members of the government.

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The tasks of the OKW did not differ essentially from those of the former War Department, but the Chief of the OKW now occupied a position equal in authority to that of the Commanders in-Chief of the services, whereas formerly the Commander in Chief of the Armed Forces had occupied a position between the Führer, and the Commanders in Chief of the Services. Thus, the Commanders in Chief of the Services obtained the right of immediate access to consultation with Adolf Hitler in all questions considered vital by them, the Chief of the OKW, being responsible for those matters concerning the Armed Forces as a whole. In accordance, with the Führer's decisions or with agreements reached by the commanders in chief among themselves, the Chief of the OKW issued orders, supervised their execution, and reported to Adolf Hitler.

QUESTION 4: The composition of the OKW in February 1938, the names (with brief biographical data) of its more important members.

ANSWER: There was likewise no substantial change in the composition of the OKW. Colonel Jodl, as Chief of the Department of Defense, took over the Armed Forces Operations Office as well from 1939 until the outbreak of war, this position was occupied by Colonel Warlimont.

QUESTION 5: The powers of the OKW, with special reference to the C-in-C, the Army, and the Navy in February 1938.

ANSWER: The authority of the OKW was substantially the same as that of the former War Department. However, the Chief of the OKW was not authorized to give orders in his own name, but signed in the Führer's name. If they were given without the Führer's knowledge and appeared inadvisable to a Commander in Chief of the services, the latter had the right to appeal to Adolf Hitler. This was known as demanding the "Führerentscheidung" (Führer's decision). Goering especially, and from the very beginning, frequently criticized, circumvented, or disregarded the directions and orders of the OKW if they were not influenced by Hitler.

QUESTION 6: The composition and authority of the OKW from the declaration of war until VE-Day.

ANSWER:

Chief of the OKW:

Field-marshal Keitel

Armed Forces Operations Staff:

Lieutenant-General Jodl (formerly Armed Forces Operations Office)

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Department of Defense:

Lieutenant-General Warlimont (later Deputy Chief of the Armed Forces Operations Staff), relieved by General Winter in 1944.

Department of Propaganda for the Armed Forces:

Brigadier General von Wedel

War Chronicle Department:

Brigadier General Scherff

Chief of Transport for the Armed Forces:

Lieutenant General Gehrke

Chief of Signal Communications for the Armed Forces:

Lieutenant General Fellgiebel (also Chief of Army Signal Communications) relieved in 1944 by Lieutenant General Praun.

Office of Foreign Relations and Defense:

Admiral Canaris. In the autumn of 1944 this office was transferred to the S.S.Main Office of State Security by order of Adolf Hitler.

Chief of the General Office of the Armed Forces:

Lieutenant General Reinicke

Office of War Economy and Armament:

Lieutenant General Thomas. In 1943 the bulk of this office was transferred to the Speer Ministry. The departments not thus transferred were reorganized to form:

The Field Economy Office:

Lieutenant General Becker.

The heads of departments and groups changed repeatedly during the course of the war and are not named separately here.

At the beginning of the war, the Führer's Headquarters came into existence. Apart from Adolf Hitler's permanent entourage it consisted of: his personal Adjutant's Office, the Adjutant's Office of the Armed Forces, the Chief of the OKW with part of the Armed Forces Operations Staff, the Reich Press Chief and liaison officers to the Reich Marshal and Reich Leader of the S.S. The most important functions of the Führer's Headquarters were carried on in railway carriages which followed Adolf Hitler wherever he went. The bulk of the Headquarters had permanent offices in Berlin or in the vicinity of the main front. During the course of the war the Headquarters was steadily broadened by the addition of more liaison officers and OKW departments.

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THE TASKS AND AUTHORITY of the OKW did not substantially change, but were diverted to the circumstances and necessities of war. During the first campaigns, the OKW acquired and maintained the character of a General Staff for the Armed Forces and a War Department.

The tasks of the General Staff of the Armed Forces were largely taken over by the Armed Forces Operational Staff. The latter dealt with the major operations of the Armed Forces after applying to the various branches of the service for suggestions concerning individual campaigns. For these major operations the Armed Forces Operations Staff issued "Fuhrerweisungen" (FÜhrer's Orders) signed by Hitler himself. It also determined the chain of command and the allocation of forces for operations. Similarly, major orders concerning supply, transport and signal communications were issued by the Armed Forces Operations Staff. This Staff also discussed military matters with allied high commands in the first instance and before individual discussion took place between the high commands of the various German services and the corresponding allied services. In addition, apart from personal reports by commander-in-chief of the services, all reports reached Hitler by way of the Armed Forces Operations Staff.

Thus this Staff was Adolf Hitler's instrument of command.

This on the whole satisfactory composition of the Armed Forces in the highest positions was abandoned when, in the winter of 1941/2, the FÜhrer personally took over the high command of the Army. Henceforth he reserved for himself the immediate direction and command of the Army so that soon the responsibility for the various theatres of war was divided.

The operations in the East were conducted according to Hitler's orders by the successive Chiefs of Staff of the Army (Halder, Zeitzler, Guderian and Krebs). Orders went direct to the Army groups and independent armies in the East. The Chief of Staff of the Army reported Hitler daily on the Eastern front, forwarded suggestions for the conduct of operations and was responsible for the preparation and execution of the operations according to Hitler's orders.

The Army General Staff retained the responsibility for the organization, training, equipment, supply, transport, administration, etc., of all the field forces.

On the other hand, however, the Chief of the Armed Forces Operations Staff henceforth directed operations in all the other theatres of war. This he did on behalf of the Chief of OKW according to Hitler's orders. Conditions for the deployment of troops, for their equipment, supply, etc., had to be established by applications from the Armed Forces Operations Staff to the Army High Command. Naturally, this was not possible without friction and frequent intervention by Hitler.

For the conduct of operations in the theatres of war themselves, the OKW came to rely increasingly on the Commanders-in-Chief of the fronts (Commanders-in-Chief of the West, South, Southeast) whose authority was limited. In addition, the Armed Forces Operational Staff continued to direct the transport for the armed forces including overseas traffic, as well as the signal communications and the propaganda for the Armed Forces.

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The Chief of the OKW personally fulfilled the functions of a Secretary-of-War. He directed all the allocation of men and material to the services, including armament industry. In addition, he was immediately responsible for the Office of Foreign Relations, and Security with the whole secret signal communications and monitoring service. Apart from the tasks of the other offices and OKW departments which have already been described, the Chief of the OKW was responsible for everything connected with P/Ws and for all welfare arrangements for war victims. His authority in these matters was fundamentally very far-reaching, but Adolf Hitler himself influenced all major decisions.

The operations of the Navy and Air Force were, in general, ordered by Hitler personally. Except when requested by the OKH or OKW in support of Army operations, they were suggested to Hitler himself by the Commanders-in-Chief of the services in question. The latter were responsible for the execution of whatever operations had been commanded. In the case of operations in support of another branch of the service, they charged the subordinate command Headquarters (Marine group detachments, Luftflotte detachments) with the cooperation with the competent army detachments (Army groups, Commanders-in-Chief of the fronts). Hitler's personal influence and the avoidance of friction in discussions concerning the execution of his orders were assured by the proximity of the FÜhrer's Headquarters to the OKH and OKL, and by the presence of a representative of the former and a representative of the Commander-in-Chief of the Navy. General discussions, including discussions with representatives of government agencies (e.g. of the State Department, of the Reich Leader S.S., of the Ostministerium (Department for the East) were provided for by a daily conference at the FÜhrer's Headquarters, the so-called "FÜhrerlage".

Thus the authority of the Chief of the OKW as compared with the Navy and Air Force was, in general, perceptible only in matters of armament, while in operational and command matters, Hitler's personal influence absolutely and directly controlled the issuing of orders. This influence grew steadily during the war, until finally Hitler wished to be currently informed of every detail - personally issued all orders arising from such details - either directly or via the OKW. This really necessitated the continuous presence of the Commanders-in-Chief of the independent branches of the service at the FÜhrer's Headquarters. Reichsmarshall GÖring, however, paid little heed to this necessity.

QUESTION 7: What effect, if any, did GÖring's alleged fall from favor in 1944 have upon the GAF? Did the Army or Navy obtain any advantage over the Air Force?

ANSWER: Nothing is known about an acute case of GÖring's fall from favor in 1944. Since the spring of 1943, there was, however, a growing estrangement between Hitler and GÖring caused by the growing air superiority of the enemy and its influence upon the fronts, the country and its production. This alienation

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grew even larger as the expected and even promised reaction of the GAF did not materialize and as instead its inferiority became more and more apparent. With the success of the enemy invasion in France, which was based upon a large air superiority, the relation between Hitler and GÖring grew into a continuous crisis which increased until the end of the war.

The other branches of the armed forces took advantage of this, especially the Army and the S.S. They requested and, with Hitler's approval, obtained from the GAF, personnel for their new units as well as the necessary weapons and equipment. The steadily decreasing effect of the GAF and the general lack of manpower and material might have justified these opinions and measures. But the GAF was thus drained to such an extent that its decrease in strength became more and more evident. A rearming had to be strictly limited. During the last few months the GAF was completely ignored on the OKW fronts. Only on the Eastern front did its successful operation continue to play a certain part.

After failure of the fighter program - mainly because of obsolete models and fuel shortage, Hitler put his last hopes on the jet aircraft production. In spite of the fact that, without considering GÖring, he appointed a special representative for all matters connected with jet-propelled aircraft, the production did not materialize according to expectations and this weapon had no effect. Meanwhile the GAF itself was used to the greatest extent for ground fighting.

QUESTION 8: Who decided which part of the German budget was assigned to the GAF during the years 1935, 1938 and 1939 as well as during the war? (We realize, of course, that after 1938 the final decision was with Hitler. However, how was this matter presented to him before as well as after 1938?)

ANSWER: Until the beginning of the war the budget requirements of the GAF were compiled annually in the Air Ministry. After inspection there they were presented by the Chief of the General Staff to the Secretary of State, who, in turn, presented them to the Minister for Air.

At the same time the requirements were discussed in detail with budget representatives of the War Department and, depending upon approval, GÖring presented these.

The War Department requested the total budget of the Armed Forces from the Government. The decision was made by the Cabinet, whose chairman was Hitler. In accordance with its decision, the War Department apportioned the reductions among the branches of the Armed Forces.

The reduction of the GAF could be partially alleviated by a higher requirement of the R.d.L. for the civilian branch and a consequent transfer to the military branch, or, in case of over consumption, by encroachment upon the following budget year.

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There was no actual budget since the beginning of the war, but only an accounting for expenses. The only limitation existed in the expenditure of foreign currency.

QUESTION 9: How were the German material reserves and manpower distributed among the branches of the Armed Forces in 1935, 1938 and 1939 as well as during the war? We think, that in 1941 GÖring was in charge of production, Funk in charge of finance, Ley in charge of manpower, Todt in charge of munitions production and that these, together with others formed Hitler's personal staff. But just how was it decided which branch of the Armed Services should have preference?

ANSWER: The Economics and Armament Department of the Armed Forces High Command (OKW) compiled the total requirements of the armament industry according to the large armament programs of the branches of the Armed Forces and according to the specialized requests of the ordnance office. The latter, besides being in charge of development, also had to look after procurement. The armament capacity on the whole was determined in detailed conference with the competent departments (Commerce department, labor department, four year plan, etc.) as well as with industry itself. A coordination of the armament requirements of the Armed Forces with other economical requirements of Germany was aimed at in accordance with the basic government decisions in regard to the military and armament economy. Then the available capacity was distributed among the Armed Forces Branches as a whole. The Ordnance Offices themselves now carried on the detailed negotiations with the industry which had been placed at their disposal and gave out the individual armament contracts.

As the necessary total mobilization was not carried out at the beginning of the war and the economic system remained comparatively unchanged, the procedure of armament procurement was not greatly altered. This applied in particular to export and especially to construction. The Armament and Economics Department continued to supervise the capacities and to apportion the available raw material allotment. The Chief of the OKW himself took an effective personal interest in this activity.

When Speer became Minister for Armament and War Production, he took over the set-up of the Armament and Economics Department of the OKW into his Ministry. He became dictator of economics to an increasing extent. He personally apportionated all raw material alotments and manpower, even at the time when he regulated only the Army's armament. His ministry received the requests of the Armed Forces branches in outline via the OKW and in detail directly from the individual branches. However, the execution of these requirements necessitated to an increasing extent the decisions of Hitler, for which the respective C in C's applied.

The assumption that in 1941 GÖring was in charge of production, Funk in charge of finance, Ley in charge of manpower and Todt in charge of ammunition manufacture is correct only in regard to the last statement. GÖring, e.g. was only the head of the so called Four Year Plan which was supposed to enforce production of raw materials. Besides that, he was reponsible only for aircraft armament.

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Ever since 1933 the Finance Department was under Graf Schwerin von Krosigk. Funk was Minister of Economics and during the war he dealt mainly with foreign trade and the stabilization of the mark.

Ley had to deal only with the social welfare of the workers. Manpower was handled by the Labor Department, mainly by its president Dr. Syrup and later on, by Gauleiter Sauckel.

There was no preferential treatment of the individual branches of the Armed Forces, perhaps with the exception of the undisputed submarine program. Preferential treatment was given only for certain types of weapons of all three Armed Forces branches. They obtained so called priorities for the availability of raw materials and armament capacities. These priorities were determined first by the OKW, later on by the Speer Ministry in cooperations with the OKW and the Armed Forces branches. Hitler often interfered in the rating of priorities, either out of his own initiative or if asked by someone else.

QUESTION 10: What effect did Speer's appointment have upon the means and ability of the GAF to obtain supplies, material and manpower? We think that Göring's fall from grace in 1944 considerably influenced the GAF's ability to obtain needed supplies, materials and manpower. However, in this connection we are mainly interested to find out if the GAF was placed in a subordinate position as compared to the other two branches of the Armed Forces.

ANSWER: At first, Speer took over only the armament of the Army, but eventually combined in his ministry all powers concerning the available armament capacity. By dissolving theconstruction department, which until then had been headed by him, and by making considerable changes in the German economy for the purposes of war production, i.e. a belated economic mobilization, he brought considerable new resources tothe armament field. Through this, as well as new ways of mass production and labor increase, he obtained a rapid growth of production. This, of course mainly helped the armament of the Army for which he was responsible.

In the fall of 1943 he took over the armament of the Navy and only in the spring of 1944 he took over GAF armament, which until then had been treated neglectfully. It was livened up, especially when, in accordance with Hitler's wish Mr. Saur, the director of the Technical department with Speer, was put in charge of aircraft production. The statement, that with the alleged fall from grace of Göring, the air armament was influenced adversely, is thus wrong. In fact, the opposite was true. In spite of this it must be said that, firstly, the livening up of the air armament came too late and that, secondly, it was confined to certain types of aircraft and the Flak artillery.

QUESTION 11: Why did the GAF fail to set up a program for the production of four engined heavy bombers? In this connection we are chiefly interested to find out who was responsible for this and why.

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ANSWER: It is correct that the GAF did not set up a proper program for the production of heavy bombers. The last armament program before the war included, to my knowledge, only three GESCHWADER of heavy bombers. As transitional airplanes for these the models FW 200 and JU 290 were considered which had both been developed from civilian aircraft. The proper combat aircraft was supposed to be the He 177. This aircraft, however, was a decided failure. It had to be reconstructed several times and finally came out so late that owing to lack of fuel it could not be used.

The decision to construct four engined aircraft should have been made, at the latest, in 1936. Only thus would a proper model have been available at the beginning of the war. This could have been used increasingly for actual operations during the war. A later change from two-engined to four-engined bombers was not possible for several reasons.

(a) Lack of time. The GAF had to be built up quickly. Owing to the continued demands on the GAF complete changes after the beginning of the war would lead to an acute decrease of all forces. The High Command did not want to be responsible for any such situation.

(b) Reasons of material, especially in regard to the production of aluminium, engines, and instruments.

(c) Lack of fuel.

(d) Replacement and training of personnel.

The highest military and technical command of the GAF itself, especially GÖring and Generals Udet and Jeschonnek, as well as the advising engineers of the GAF technical department, were responsible for the opinion that light aircraft should form the core of the GAF. Besides, the greater part of the leading personalities in the GAF, including GÖring, had come from the fighter force of World War I. In the beginning, Hitler himself kept completely out of the considerations and decisions and relied upon the "expert" judgment of GÖring. Even later on he only made suggestions and gave his personal opinion without giving direct orders. As already mentioned, this was only changed in 1944.

QUESTION 12: Did the German Navy ever get a separate Air Force in the years between 1939 and the capitulation?

ANSWER: The Navy High Command continuously asked for the creation of a separate Naval Air Force. It based this upon the characteristics of naval warfare which require special training and steady cooperation with the Air Force. From the beginning GÖring was very much opposed to this request. Hitler supported him in this respect. GÖring was of the opinion that the GAF was too weak to give personnel and material to the cooperative Air Forces of the Army and Navy. The thought was that the success of the Air Force operations was guaranteed only by heavy concentration of all forces. Otherwise during the war, the requirements of the Navy were strictly concerned with reconnaissance of coastal and adjoining sea areas, as well as occasional support of naval operations.

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Later on, the most important part was played by the necessary reconnaissance for the submarine warfare in the Atlantic and the protection of convoys to Norway and the Mediterranean. Except for the submarine reconnaissance, which owing to lack of aircraft whose range was sufficiently long lagged behind the requirements of the Navy, its other requests could generally be satisfied.

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EASTERN ARCTIC SURVEY

1942

BY

MAJOR HAROLD K. KELLEY

CAPT. JOHN M. BENNETT

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EASTERN ARCTIC SURVEY

8 July, 1942 to 14 October, 1942

Narrative of Survey

In accordance with secret order, War Department, Adjutant General's Office, dated June 25, 1942, the members of this survey reported on board the R.M.S. Nascopie on July 8, 1942. The personnel included:

Major Harold K. Kelley, AAF (CE)
Captain John M. Bennett, AAF (Pilot)

The purpose of this expedition was to locate, at the various ports of call of the Nascopie, possible sites for the construction of air fields in Canada and especially on the northern end of Baffin Island.

The Nascopie sailed on schedule at 1015 o'clock July 8, 1942, and proceeded on its voyage, calling at the following ports approximately on the dates shown:

Hebron, Que.	July 16
Port Burwell, Que.	July 22
Resolution Island, N.W.T.	July 22
Lake Harbor, N.W.T.	July 24
Sugluk, Que.	July 26
Cape Dorset, N.W.T.	July 28
Wolstenholme, Que.	July 29
Nottingham Island, N.W.T.	Aug. 1
Southampton Island, N.W.T.	Aug. 3
Cape Smith, Que.	Aug. 5
Port Harrison, Que.	Aug. 7
Churchill, Manitoba	Aug. 12
Chesterfield, N.W.T.	Aug. 26
Nottingham Island, N.W.T.	Aug. 30
Wolstenholme, Que.	Aug. 31
Lake Harbor, N.W.T.	Sept. 2
Cape Hopes Advance, Que.	Sept. 3

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Resolution Island, N.W.T.	Sept. 10
Arctic Bay, N.W.T.	Sept. 22
Pond Inlet, N.W.T.	Sept. 27
River Clyde, N.W.T.	Sept. 29
Pangnirtung, N.W.T.	Oct. 3
Ivigitut, Greenland	Oct. 9

The schedule of calls included Fort Ross, N.W.T., which is on the north end of Boothia Peninsula, but due to new ice forming and solidifying the pans of old ice, the ship was unable to reach this port of call.

Ice conditions were favorable for navigation this year. With the exception of a few icebergs along the coast of Labrador, no ice was seen until we were in Hudson Strait. A field of pan ice was passed through on entering Lake Harbor on July 24, 1942, but it was well broken up and no difficulty was encountered. This ice had blown out of the harbor at Lake Harbor the preceeding day. More pan ice was seen on entering Cape Dorset, N.W.T., on July 27, 1942. This also was well broken up. No other ice was encountered in Hudson Strait or Hudson Bay. After leaving Hudson Strait on September 14th we saw numerous icebergs in Davis Strait and Baffin Bay. When we entered Lancaster Sound on September 19th we found much pan ice, averaging about six feet in thickness. The Nascopie encountered no great difficulty in getting through this ice, since there were open stretches of water where these pans could be pushed.

Prince Regent Inlet contained much pan ice and by September 21st new ice had formed about an inch thick. By September 22nd we had reached a position approximately opposite Fury Point in Prince Regent Inlet. A strong north wind was blowing at this time and pushing more ice down the Inlet from Lancaster Sound. Fearing that the new ice would solidify the pans of old ice and prevent our return, the Captain of the Nascopie turned back without reaching Fort Ross.

Numerous icebergs were seen in Admiralty Inlet, Navy Board Inlet, and Pond Inlet, but there was very little pan ice in these waters. From Pond Inlet to Pangnirtung to Greenland we encountered no pan ice but saw many icebergs.

The Nascopie arrived in Greenland on October 9, 1942, intending to take on a load of cryolite from the mine at Ivigtut. There were four ships ahead of us waiting to be loaded; our expected date of loading was October 22nd. Since our reconnaissance was finished, we left the Nascopie at Ivigtut and flew to Bluie West 1 in a Coast Guard PBY plane. From there we flew to Presque Isle, Maine, and then to New York City and returned by train from there to Washington.

With the exception of Southampton Island and Churchill, where construction has already started, Pond Inlet, N.W.T., and River Clyde, N.W.T.

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were the only places visited which offered favorable conditions for the construction of air bases. Port Harrison, Quebec, offers a possibility but construction would be difficult and the weather is not favorable. Complete reports on these follow, with brief reports on all ports visited, except Southampton and Churchill, as well as reports on several places not visited by us (Coates Island, Povungnituk, Gifford River) but which reputedly are possible sites.

Pond Inlet, N.W.T.

At Pond Inlet, N.W.T., it is possible to construct a two-runway air base.

This settlement is located on the northeastern coast of Baffin Island at lat. 72° 40', long. 77° 43'. The land north of Eclipse Sound and Pond Inlet rises to rugged mountains of 5,000 feet with glaciers forming in the heights. The area to the east of the post rises gradually to the south. To the west, however, the ground flattens out and offers a suitable spot for an air base.

There is no protected harbor in Eclipse Sound near the proposed site, but there are excellent anchorages and the beach is gradual and composed of sand and rough small stones. The tide rise and fall is about eight feet.

On the site reconnoitered, which is west of Salmon River (see map, Tab B), the land is relatively flat. It is covered with bunch grass and interspersed with small lakes. When we walked over the area, the ground was frozen and covered with about two inches of snow. It appeared from the numerous small lakes and tussocks of grass that the land would be a swamp when the ground was not frozen. However, the inhabitants assured us that it was not a swamp, but sandy soil that was solid after the thaw. It was also learned from the natives that none of the lakes was over four feet deep. Two 6,000 foot runways with good approaches could be put in here in the general direction of E-W and NE-SW. It might be possible to to construct these runways so that the angle of intersection would be as great as 60°, but this would be difficult.

The prevailing wind is from the northeast throughout the year. This is undoubtedly due to the topography of the country; the high hills on each side of the Inlet form a tunnel for the wind from the northeast. Usually there are about two strong blows per year from the northwest which last about four days.

The extreme temperatures are + 58° and - 62° F. The fresh water

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begins to freeze about the middle of September and the sea ice begins to form about the middle of October. The fresh water ice begins to thaw about the latter part of May and disappears in late June. The sea ice usually breaks up in June but does not go out of the sound until the middle or last part of August. The permanent frost in the ground is found between two and four feet.

Southwest of the settlement about ten miles there is reported to be a large fresh water lake, approximately two miles by three miles. By the end of September the ice is a foot thick on this lake and by December it is between six and eight feet thick, depending upon the snow fall. The ice is still strong enough in May to carry any planeload, although toward the latter part of the month it begins to thaw around the shore line.

Approximately three miles southwest of the proposed site there is a coal mine. A low grade of lignite is found here in undetermined quantities. The Hudson Bay Company post and the missionaries burn this coal, but the Royal Canadian Mounted Police import their coal via the Nascopie. It takes about three times as much of the local coal by weight to get as much heat as is produced by a unit of good anthracite coal. The coal must be handled carefully to keep it from pulverizing (the natives usually mine it in freezing weather to prevent this). The smoke given off from this coal is very thick and dirty, clogging up the stovepipes frequently and depositing a greasy soot.

Since the ice does not leave the inlet until August, shipping cannot start until that month. This would give about one month in which to work before the ground begins to freeze again. It is believed that both runways could be graded in this short period and allowed to freeze into a relatively good surface for the winter. With the equipment on the site, workmen could be flown in just prior to the thaw in the following spring, and a hard-top surface could be put on the runways in the summer months.

Strategically Pond Inlet is important for a trans-polar flight to Spitzbergen or Franz Josef Land.

Pond Inlet to Southampton Island	610 miles
Pond Inlet to Chrystal 2	660 "
Pond Inlet to Spitzbergen	1400 "
Pond Inlet to Franz Josef Land	1750 "

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River Clyde

There is land in the vicinity of River Clyde which would be suitable for the construction of an air base.

The inlet into the mouth of River Clyde is located at lat. 70° 26' and long. 68° 50'. There is a well-protected harbor on the north side of the inlet which affords excellent protection and anchorage for vessels of any size. This bay is approximately five by seven miles in size. The tide here amounts to only five feet.

Along the eastern shore of Baffin Island, between Eglington Fiord and Cape Christian, there is a low coastal plain extending inland for several miles. This gently rolling country is bordered on the west by hills which may reach altitudes of 3,000 feet. However, these hills are some six to ten miles away and there are numerous openings and passes between them.

The area reconnoitered is southwest of Cape Christian. The land here is relatively flat, spotted with fresh water lakes. Small boulders averaging about two feet in diameter are sprinkled over the entire terrain. The land appears to be covered with glacial deposit of crushed granite. Natives informed us that this formation is about three feet deep and that beneath it there is approximately a foot of sand and then clay. The permanent frost appears about five feet below the ground surface. A good coarse sand, suitable for concrete, was found along the shores of some of the lakes. Due to the frozen ground and snow, it was impossible to determine the amount of sand available.

Runways with good approaches could be built in any direction, but would involve filling in one or more of the lakes. A NE-SW runway 6,000 feet long could be constructed without having to fill any lakes or contend with much of a drainage problem. It is quite possible that a better area than the one reconnoitered can be found northwest of Cape Christian. However, supplies would have to be unloaded in the bay near the trading post, as it would be nearly impossible to unload cargo on the unprotected Baffin Island coastline.

The extreme temperatures for the year 1941-42 were -52° and +60° F. The most unsettled weather is during the months of July, August, and September, and is accompanied by rain, fog, and low ceilings. In the winter, the weather is generally clear and the prevailing wind is from the northwest. The Canadian Government has no official weather reports on River Clyde.

The ice in the bay begins to form about October 15th and breaks up

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in early June. This ice is usually smooth and would be suitable for ski-plane landing. Although the ice breaks up in June, the harbor is not entirely clear until the end of August. The fresh water ponds and the ground begin to freeze about October 1st and to thaw about May 15th.

There is a Hudson's Bay Company post located here, with a manager and clerk. This post has a low-powered radio station (30 watts) which transmits on 4356 kc. At present there is being built by the U. S. Government and the Canadian Government a combination meteorological and radio station which will have a 300 watt transmitter (voice and CW) and should be in operation by December 1, 1942. Exceptionally good radio reception is reported in this locality.

An airport at this location should be valuable as an intermediate airport in case steps are taken to move long range bombers and transports "over the top". Distances are approximately as follows:

River Clyde to Crystal 2	465 miles
Crystal 10 (Southampton)	575 "
Spitzbergen	1450 "
Franz Josef Land	1825 "

Should the enemy occupy and develop airports on Spitzbergen and Franz Josef Land, this location would be valuable from a defensive point of view.

NOTE: Staff Sgt. Delore Martell, U. S. AAF, is now located at River Clyde. It will be possible to communicate with him through the Canadian Meteorological Service, Toronto, after December 1st. A code arrangement has been set up, so that it will not be necessary to send messages in the clear.

Port Harrison, Quebec

There is a possible site for an air base at Port Harrison. This settlement is located on the eastern side of Hudson Bay almost due east of Churchill, and is one of the largest posts on the bay. A river empties into Hopewell Sound at this point. The sound is enclosed by some of the islands of the Nastapoka-Ottawa group which lies as a fringe paralleling the mainland and extends from the Belcher Islands northward about 250 miles (see sketch, Tab B). Hopewell Sound has deep water and offers protection and good anchorages for vessels. The tide rise and fall amounts to only three feet. Annie's Passage, the closest inlet to the sound near the proposed site, is not charted, although there appears to be deep water here.

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Strategically Port Harrison is important; it is almost on a direct line of flight from Churchill to Fort Chimo, as well as being on a line between Montreal and Southampton Island. An airport here would be excellent as an intermediate landing field. The country between Port Harrison and Fort Chimo is reported to be relatively flat, making a flight between these two places comparatively safe.

The best location for a runway is approximately five miles south of the settlement, just south of Hopewell Narrows, on the east shore of Hopewell Sound (see sketch). The site is a rolling marshland with two small ponds on the southern end, and crossed by two small streams which drain the area to the east. The land is covered with moss and sprinkled with loose boulders of granite averaging about 12" to 18" in diameter. The soil is in the most part sandy with patches of gumbo appearing in various places.

Except for the granite deposits to the east, there is no local material for the construction of a runway. The granite is bedrock and would require blasting prior to crushing. It appears that the quickest and perhaps cheapest way to put in a runway here would be the installation of a steel mat. The site is suitable for a 5,000' x 500' runway, NW-SE, and since prevailing winds in both summer and winter are from the northwest it is believed that the one runway would be sufficient. There are good approaches to this site from both directions.

On the north side of Hopewell Narrows is a small area which might take a runway 3,500' x 500' in a WSW-ENE direction. The soil is sandy there also, but in places there are outcrops of bedrock which would have to be removed. The approaches are bad, especially from the west. Rocky cliffs on Harrison Island rise 100' above the level of the site less than three-fourths of a mile away.

The ice in the sound forms about the middle of November and usually freezes very smooth. It usually breaks up and clears the harbor in May. With a grader to clear drifts from the ice, an airfield could be laid out with runways in any direction which would be usable for about five months a year. The sound is excellent for a seaplane base from the middle of June through October.

The Canadian Government Radio Station, which is in conjunction with the meteorological station, operates twenty-four hours a day on 500 kc. (100 watts). Very shortly, this station will be equipped as Nottingham Island and will be able to give bearings to both ships and planes. This station also contacts Hudson's Bay Company posts in this vicinity, transmitting on 3437.5 kc. and receiving on 4356 kc.

The weather station at Port Harrison reports the minimum temperature for 1941 as -40° F. and the maximum as 72° F. The prevailing winds at

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all times of the year are from the northwest. Winds from the northwest bring good weather and nearly all winds from a southerly direction bring bad weather. Fogs average about three days a month in the summer and less than two days a month during the rest of the year.

In addition to the Canadian Government meteorological and radio station, the settlement consists of the establishments of the Hudson's Bay Company, the Baffin Trading Company, and an Anglican mission. There was formerly a Province of Quebec police post here, but it has been abandoned. These buildings are in fair condition and accomodate about five men. About twelve white people live here, and some three hundred fifty natives live in the area and trade at this post.

Coates Island

Coates Island is in the northern end of Hudson Bay, about seventy miles south of Southampton Island. Although we did not visit this island, people who are familiar with this area report the terrain to be similar to that part of Southampton where the U. S. Army Air Forces propose to build an air base. Good anchorage for sea vessels is reported.

The island is uninhabited except by a few Eskimo families that hunt there in the winter months. The weather is reported to be similar to that found on Southampton Island.

Due to its proximity to Southampton, the strategic value of Coates Island is questionable. Depending upon the amount of traffic contemplated between Churchill and Southampton, it might be well to consider the construction of an emergency landing field here.

It is recommended that Coates Island be further studied from the air when flying is established at Southampton. We are advised that the position of the island as shown on the navigation charts is about eighteen miles too far east.

Harry Gibbon, a half-breed native who is now working for the engineers at Southampton, probably knows more about Coates Island than anyone else around Hudson Bay.

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Povungnituk, Quebec

Povungnituk is located on the east side of Hudson Bay about 95 miles north of Port Harrison. Although this place was not visited, a Hudson's Bay Company post manager formerly located there reports that there are large level spots of ground on the coast between the Koglax and Povungnituk Rivers.

This area might be suitable for the location of an air base. The climate is reported to be similar to Port Harrison. However, there are shoals along the shore extending out for many miles. These waters are uncharted and navigation is reported difficult even in small boats.

Gifford River

Deer Plain is located on Baffin Island between the headwaters of Gifford River and the head of Admiralty Inlet (approximately lat. 71° and long. 84°). This is reported to be very flat and level country. People traveling over this country when it is covered with snow have often thought they were over water.

The disadvantage of this area is the difficulty of reaching it by boat. The upper end of Foxe Basin is frequently congested with ice throughout the summer. It is debatable whether vessels of any size could reach the head of Admiralty Inlet.

Stratigically the locality may become important as an intermediate airport for planes in flight to the north. Deer Plain is approximately 445 miles true north of Chrystal 10.

There is no trading post or settlement at this place. The nearest Hudson's Bay Company post is Igloolik, about fifty miles south. There is a native settlement about fifty miles north, at Moffet Inlet.

This information was obtained from the following men who have traveled over this country:

Sgt. H. A. McBeth, R.C.M.P., Pond Inlet, N.W.T.
Alan Scott, Hudson's Bay Company, Chesterfield Inlet.
Norman Ross, Hudson's Bay Company, Pongnituk, N.W.T.

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Hebron, Labrador

There is no suitable area in the vicinity of Hebron for a land base for airplanes.

This settlement is located on the northeast coast of Labrador at approximately 58° 15' lat. Barren, rugged hills which rise two to three hundred feet above sea level surround the bay and extend for many miles inland.

The bay in which Hebron is located affords an excellent anchorage for vessels, being well sheltered from all except southwest winds. In 1941 the RCAF established a seaplane base here and did some survey work. As yet (July 20, 1942) the RCAF have not returned to Hebron this year. They have about five thousand gallons of gasoline stored here. A radio station was put in, but is not operating at present.

Ice usually begins to form in the bay in the latter part of September and leaves about the middle of July. However, drift ice often enters the harbor after the shore ice has gone. This year the harbor was clear by the middle of June, but in 1941 the drift ice lasted until August. There is very little tide in the harbor and, being well sheltered, the ice usually freezes smooth. This relatively smooth solid ice remains from about December through May, when it begins to break up. For about five months the iced harbor could be used by land or ski-planes by employing a roadgrader to take off the surface snow drifts or uneven spots.

The prevailing wind is from the northwest, thus maintaining contact weather in the winter, as the fog rises over the water beyond the shore line.

Hebron, Labrador to Button Islands, Quebec

The coast of Labrador north of Hebron is the same rugged, barren landscape as is found at Hebron. There appear to be many sheltered bays along the coast which could afford the same uses as the bay at Hebron. However, the northern end of Labrador is subject to winter fogs which are blown in from Ungava Bay and Hudson Straits.

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Port Burwell, Quebec

There is no suitable area in the vicinity of Burwell for a land base for airplanes. This settlement is located on the northeast coast of Ungava Bay. It has all of the disadvantages of Hebron, without the advantage of a well-protected harbor.

Resolution Island

Resolution is located on the northern side of the entrance to Hudson Straits. Barren, rugged hills, high winds, and disagreeable weather would make this place unsuitable for any type of aircraft operations.

Lake Harbour, N.W.T.

Lake Harbour has no suitable area in the vicinity for a land base for airplanes.

The settlement is situated at the end of a long inlet at the head of North Bay, on the southern coast of Baffin Island. The harbor is well sheltered, being eleven miles from open sea. The water is deep up to the end of the harbor, which is about 650 feet wide at the narrowest place. In 1937 the British warship H.M.S. Scarborough navigated up the harbor. The maximum rise and fall of the tide is thirty-eight feet; however, the tide amounts to only about twenty feet in the summer.

Information from the inhabitants discloses that there is a large plateau about thirty miles from the settlement, but the only approach to it is over very rugged country. The terrain adjacent to the harbor is from fifty to seven hundred feet high and as you progress inland to the north a mountain range rises to 1700 feet. Beyond this is the inland plateau.

The harbor would be excellent for ski-planes in the winter (from December to May) and for seaplanes when the ice clears, usually about the middle of July, until it reforms late in September or in October.

A Hudson's Bay trading post is located here and supplies about 275 natives in the vicinity. The post has a low-powered wireless station which hooks in with the Canadian network at Nottingham Island.

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Sugluk, Quebec

There is no area in the vicinity of Sugluk suitable for a land base for airplanes.

The settlement is situated on Sugluk Inlet, which is a coastal indentation on the south side of Hudson Straits. On both sides of the thirteen mile inlet rugged hills rise from the water to about eight or nine hundred feet.

High winds are numerous, and, due to the roughness of the terrain, cross winds and down drafts are common. Because of this wind condition it would not be advisable to use this inlet for seaplanes or ski-planes.

There is a Hudson's Bay post and a Baffin Trading Post located here and they supply about 130 natives. Hudson's Bay Company operates a low powered wireless set.

About thirty miles due south of Sugluk there is reported to be a huge area of gently rolling country which could easily be converted into a flying field. However, its inaccessability to anything but planes, and dog sleds in the winter, does not make it a promising location from the viewpoint of construction and supply.

Cape Dorset, N.W.T.

There is no area in the vicinity of Cape Dorset for landbased airplanes.

This settlement is located on Dorset Island, which is one of a group of islands just off the southwest coast of Baffin Island at the entrance of Hudson Straits. This area is characterized by high, rugged hills which average about 780 feet.

In spite of a fairly well protected harbor, the wind frequently reaches a velocity of 60 m.p.h. in the winter. For this reason it is doubtful if this area would be suitable for ski-planes.

The ice in the harbor is frozen solid from the end of December until the middle of May. However, broken ice frequently remains in the harbor until the middle of July.

The Hudson's Bay Company maintains a trading post and a low powered

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radio station. The white population numbers two, and there are approximately 371 natives.

The Royal Canadian Mounted Police, who are familiar with this area, report that there is a plateau north of Cape Dorset about forty miles. However, due to the rugged hills which extend from the coast inland, it would be very difficult to transport supplies to this point.

Wolstenholm, Quebec

There is no area in the vicinity of Wolstenholm which would provide a suitable land base for airplanes.

This settlement is located on the southwest end of Hudson's Straits in a well-protected cove which offers good protection and anchorage for vessels. Barren, rugged hills rise abruptly to over nine hundred feet.

The comparatively narrow channel with high hills on either side creates a wind draft through here at all times of the year. Due to this high wind velocity, this place is not recommended for either ski- or sea-plane operations.

The range of temperatures at Wolstenholm is from -42° F. to 70° F. During the months of June, July, August, and September there are frequent rains accompanied by low ceiling and poor visibility. In the winter the visibility is also poor, due to drifting snow blown by the high winds.

The harbor usually begins to freeze solid in December and the ice clears out in early July. The tide rise and fall amounts to about eighteen feet.

The Hudson's Bay Company maintains a trading post and a low powered wireless station. The white population is two and the native population is 145.

Nottingham Island, N.W.T.

There is no area on Nottingham Island suitable for a land base for airplanes.

The island is in Hudson Straits; it has no harbor, and supply ships of any size must lay about two miles off shore because of rock shoals.

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The current here is very swift, running as high as six or seven knots per hour. The island is relatively flat, but is practically all bedrock, making any airport construction next to impossible.

The Canadian Government maintains a wireless station here which is able to give bearings to both vessels and planes, as well as reporting weather conditions. The personnel of this station is being increased in September, 1942, and will operate the station on a twenty-four hour basis. The station has 100 watts power and guards 500 kc. continuously. The station also has a regular schedule to contact the various Hudson's Bay Company stations in this area. The Nottingham station transmits on 3437.5 and the Hudson's Bay stations transmit on 4356 kc.

Cape Smith Island, N.W.T.

There is no suitable area in the vicinity of Cape Smith for a land base for airplanes. This is the largest of a group of islands along the northeast coast of Hudson Bay. Steep, barren hills of rock rise to three and four hundred feet abruptly from the sea.

There is no harbor for vessels, and the anchorage off the island is poor. During high winds, which are frequent, vessels must move away from the island because their anchors will not hold.

The Hudson's Bay Company maintains a trading post here to take care of the 135 natives. The post is run by two white men who also maintain a low-powered company radio station.

Midway between Wolstenholm and Cape Smith, along the coast of Hudson Bay, there is reported to be a stretch of very flat land. Due to this flat terrain there are shoals extending off shore which have never been charted. However, many natives in this locality know the waters in that vicinity and believe it possible to chart a channel through the shoals.

Chesterfield, N.W.T.

There is no suitable area in the vicinity of Chesterfield for an air base. The settlement is situated on the northwestern shore of Hudson Bay, near the entrance to Chesterfield Inlet. The surrounding land is low, rocky, and dotted with many small lakes. Due to this low land Chesterfield is much exposed to winds from all directions; the prevailing wind is from the northwest.

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There is no protected harbor here, and the anchorage is very poor. This condition, combined with strong winds and a fifteen-foot tide, makes unloading cargo from ships very difficult.

The Canadian Government maintains a 100 watt radio station here which gives bearings to ships during the navigation season, sends out meteorological reports daily, and is able to give bearings to airplanes. The personnel at this station has been increased this year (1942) and will operate on a twenty-four hour basis. It guards 500 kc. continuously as well as having definite schedules for contacting Hudson's Bay Company posts.

In addition to the Hudson's Bay Company post and the radio station, the settlement has a Roman Catholic church and hospital, a doctor's house and a R.C.M.P. detachment.

The population comprises 21 white people and 250 Eskimos.

Cape Hope's Advance

There is no area in the vicinity of Cape Hope's Advance suitable for construction of an airbase. It is located on the northwestern shore of Ungava Bay (lat 61° 05', long. 69° 33'). High, rugged hills rise from the shore to five or six hundred feet.

This year (1942) the Canadian Government has re-opened a radio direction finding station to aid navigation through Hudson Straits. It is powered with a 100 watt transmitter.

Arctic Bay, N.W.T.

There is no place in the vicinity of Arctic Bay which would be suitable for land based airplanes.

This settlement is located near the north end of Baffin Island at lat. 73° 05', long. 84° 00'. Arctic Bay is almost circular in shape and about a mile and a half in diameter. It is well protected and offers good anchorage for vessels. On the south the bay opens into Adams Sound, which in turn flows into Admiralty Inlet. The bay is surrounded by hills rising to heights of eight to twelve hundred feet. The rocks of these hills are composed of stratified limestone, sandstone, and shale.

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Some of the hills in the vicinity of Arctic Bay have rather flat tops. None of these flat areas proved to be longer than 2700 feet in any one direction. It is possible that an extensive aerial survey of this area might develop one of these plateaus large enough for an air base. However, the very steep climb (600-1000 feet) to the top of such a place would make airport construction extremely difficult.

There is a possibility of using Arctic Bay for ski-planes from October 15th to June 1st. It also might be used for seaplanes during August and September. The mean tide at Arctic Bay is three feet.

The winter temperature reaches as low as -52° F., while the summer temperature usually ranges around 50° F. The months of August and September seem to produce the most unsettled weather conditions, accompanied by rain, snow, and low ceilings. The residents at this post report exceptionally calm clear weather during the winter. In connection with winter flying in this area, it should be remembered that the sun sets on November 7th and does not rise again until February 7th.

The Hudson's Bay Company maintains a trading post here which operates a low powered radio station. The U. S. Department of Commerce, together with the Meteorological Division of the Canadian Department of Transportation, is installing a complete radio and weather station. This station will be powered with a 350 watt transmitter and will be equipped to make balloon observations. It should be in operation by December 1, 1942.

The population of Arctic Bay consists of 4 white men and 126 natives.

Pangnirtung, Baffin Island, N.W.T.

There is no land in the vicinity of Pangnirtung which would be suitable for the construction of an air base.

Pangnirtung lies in a fiord which comes into Cumberland Sound from the northwest. This settlement is near the southern end of Baffin Island at lat. 66° 8', long. 65° 28'. The adjacent country is characterized by narrow valleys with precipitous walls. The fiord offers good protection and anchorage for vessels. The tide is about twelve to fifteen feet.

This settlement is the largest in the eastern Arctic. In addition to the Hudson's Bay Company post, there is a Royal Canadian Mounted Police detachment, an Anglican mission, and a hospital. The hospital has three nurses, a doctor, and X-ray equipment.

The extreme temperatures are 60° F. and -50° F. The prevailing wind

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is northeast, or down the fiord.

The Hudson's Bay Company operates a 30 watt radio station (CY7N) on 4356 Kc.

The population is 15 white people, and 492 natives.

NOTE: This area was surveyed by air in August, 1941, by Lt. Colonel Elliot Roosevelt, et al.

Harold K. Kelley
HAROLD K. KELLEY,
Major, Corps of Engineers.

John M. Bennett
JOHN M. BENNETT,
Captain, Air Corps.

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TAB A

POND INLET - WEST OF SALMON RIVER LOOKING NE. 9/27/42

POND INLET - LOOKING INTO ECLIPSE SOUND 9/27/42
Showing Grounded Icebergs

DAVIS STRAIT NEAR BYLOT ISLAND 9/26/42

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RIVER CLYDE - LOOKING NORTHEAST 9/29/42

RIVER CLYDE - LOOKING NORTH 9/29/42

CLOSEUP OF GROUND - RIVER CLYDE 9/29/42

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LANCASTER SOUND LOOKING WEST 9/21/42

LANCASTER SOUND ENTERING PRINCE REGENT INLET 9/21/42

PRINCE REGENT INLET LOOKING SOUTH 9/21/42

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ARCTIC BAY SHORE LINE

ARCTIC BAY - SHOWING HIGH PLATEAUS

TOP OF PLATEAU IN PICTURE ABOVE

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CAPE DORSET, N.W.T. 7/23/42

SOUTHAMPTON ISLAND, N.W.T. 8/3/42
Similar terrain reported on Coates Island

WOLSTENHOLME, QUE.

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HEBRON, LABRADOR 7/16/42

LAKE HARBOR, N.W.T. 7/24/42

LAKE HARBOR - SHOWING TIDE FALL 7/23/42

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HUDSON STRAITS ENTERING LAKE HARBOR 7/23/42

HUDSON STRAITS ENTERING CAPE DORSET 7/27/42

NORTHEAST COAST OF BAFFIN BAY 9/28/42

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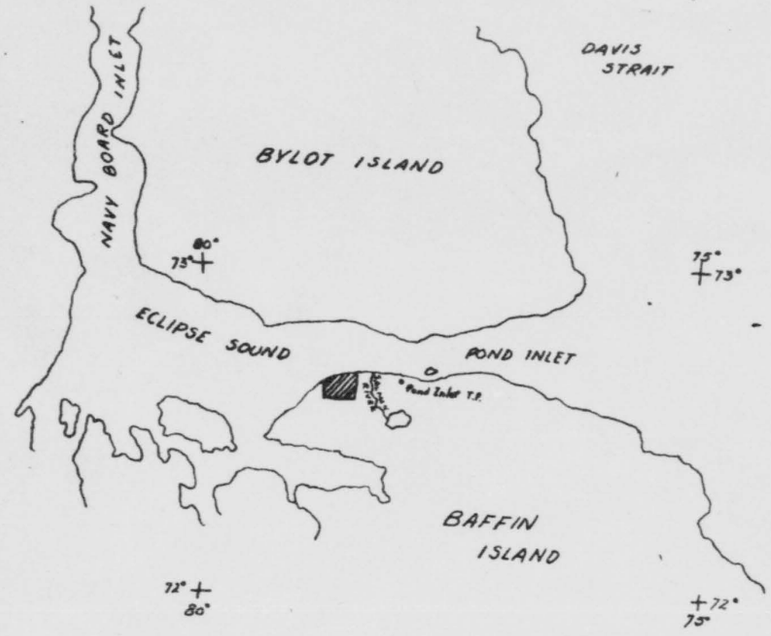
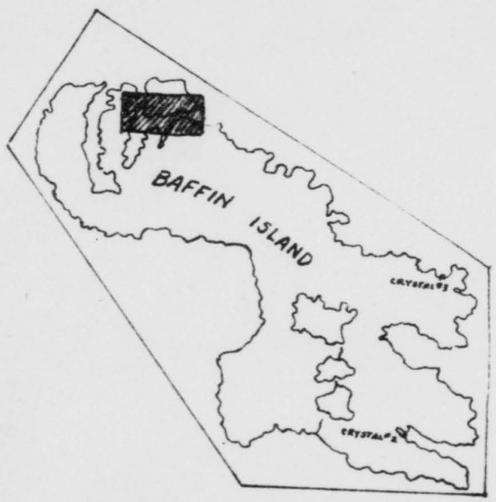


ARCTIC ARCHIPELAGO
ADMIRALTY CHART, 1926
NUMBER 2118

TAB B



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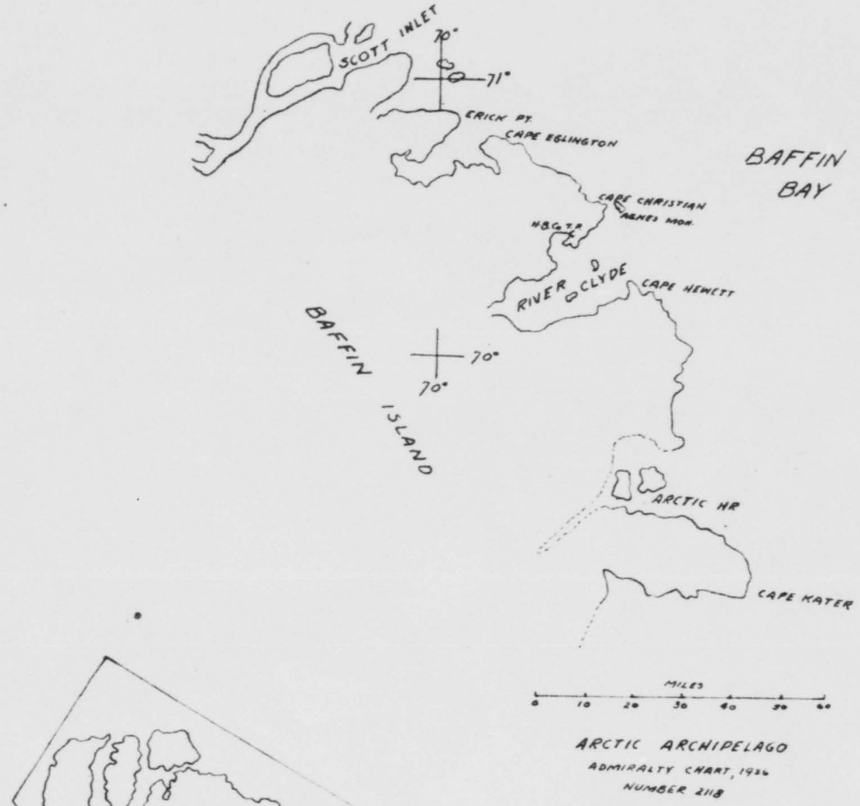

ARCTIC ARCHIPELAGO
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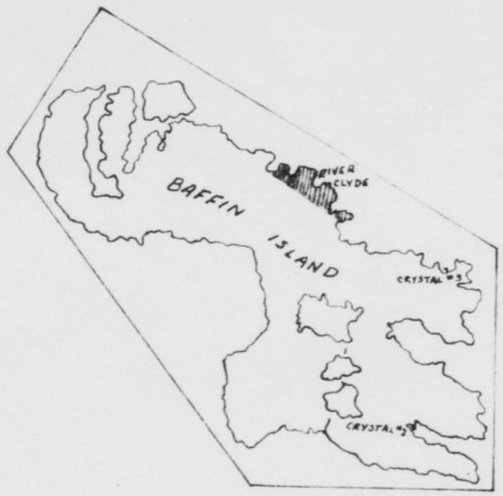

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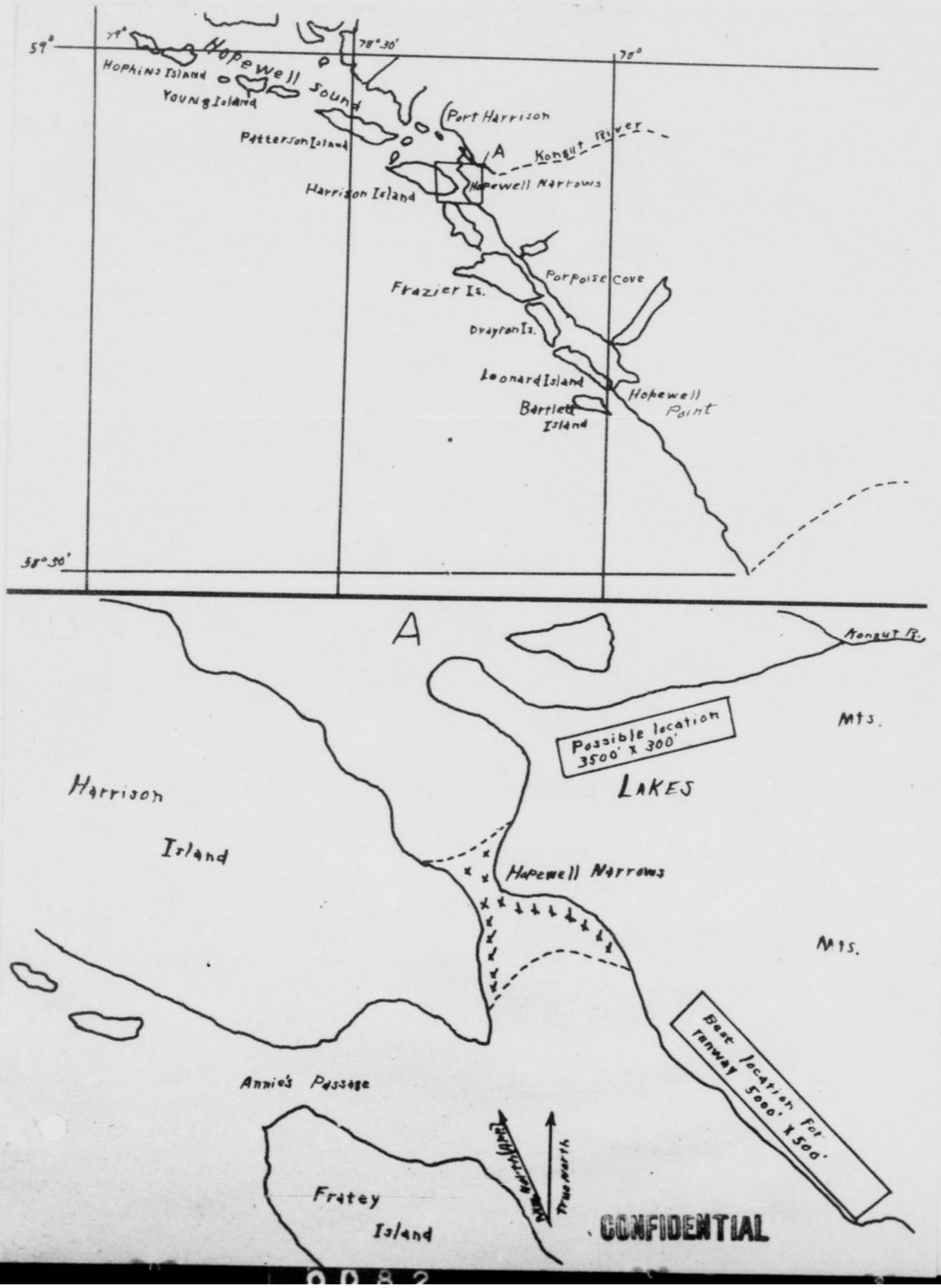

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AIR ESTIMATE GENERALS ADLER AND BRETT, Dec. 13, 1941

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HEADQUARTERS ARMY AIR FORCES
ROUTING AND RECORD SHEET

JAN 21 '42 PM

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File No. 3

Tel. No. AAF

RECEIVED
AIR WAR PLANS DIV.

Note.-- A line will be drawn across sheet after each comment.

SUBJECT: Estimate of Air Situation.

NO.	FROM	TO	DATE	COMMENTS
1	S/AS	AAF/AWP	1942 1-21	1. The attached letter from General Brett to General Arnold, and an estimate of the air situation presented by General Adler, are submitted to you for your information and whatever use you may make of them. They will be retained by you unless you consider it advisable to forward them on to War Plans Division, General Staff. Incl. Ltr. 12/13/41 Est. Air Situation R. A. D.

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AUTH: 9200.9, 22 Jun 44

(Do not use reverse side) W-4071, AC. Rev. 8/14/41

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Estimate of Air Situation.

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Incl.
Let. 12/13/41
Est. Air Situation

R. A. D.

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LEGATION OF THE
UNITED STATES OF AMERICA
OFFICE OF THE MILITARY ATTACHE
CAIRO, EGYPT.

December 13, 1941

Major General H. H. Arnold
Office of Chief of Air Force
War Department
Washington, D. C.

Dear Hap:

On my way to China in the morning and I write for one specific purpose. As a result of a great deal of thought, conversations with Maxwell and Adler, various British officials and our appreciation of the situation here, we started on an estimate trying to prove the priorities in the Middle East should not be reduced. After much discussion, as mentioned above, an estimate was written which has been prepared by Adler. This estimate in condensed form is being forwarded to you by cable and the complete estimate will be mailed by Adler, probably on the same plane as this letter. You must remember that this estimate is built with a slightly biased point of view but yet with a very detached point of view - that is, we are not under the influence of public opinion in the United States - and I have the firm feeling that it is by far the best estimate I have heard yet. It actually has a great deal to do with my knowledge of England and their ability to take care of themselves. It also has given due consideration to the political picture on both sides of the Mediterranean, the present Russian situation and an honest endeavor to get at Japan. I suggest very strongly that you read it carefully and give it all due consideration.

Have no idea in the world what I am bumping into on this new trip. I have picked up every bit of possible information here and the key of the entire situation seems to be the Burma Road. I may have to actually drive it in order to find out if it is suitable line of communication. Everything is going fine, we are all fixed up and should be in Basra tomorrow night, Karachi the next night, Delhi or Calcutta the following night. We will then have to pick up a lot of information before we can go further. However, I have every hope of being in Chunking sometime the latter part of the week.

Best of luck.

Sincerely yours,

Spaatz.

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AN ESTIMATE OF THE AIR SITUATION

1. A study of the military geography of the world with respect to the application of air power in the present war indicates that a controlling factor will be the location of sufficient space from which a major air offensive can be launched. Space, as used in this sense, envisages not only the area on which combat units can be located, but the lines of communication that must extend from that area to the zone of the interior, in order to sustain operations.

2. The major and directing power of the Axis is Germany. Ultimately the war can be won only by the complete defeat of Germany. Air power must, therefore, be applied to the limit of its capacity in the destruction of those facilities which make it possible for Germany to continue the war. The targets are located in Europe and primarily within the boundaries of German territory; Italy, as well as other minor allies, will undoubtedly fall if German resistance is destroyed.

3. The effort of Japan in the Far East is undoubtedly designed to effect a Pan-Asiatic Japanese control, and also to support Germany to create a major diversion which will occupy the time and resources of the United States, the British in the Far East, and the Dutch East Indies. It is believed that Japan is incapable of conducting a major offensive against the continental limits of the United States, and minor raids only might be expected. Hence again, it is apparent that the major application of air power must be in the European theater.

4. Before the resources of the United States and its allies can be gathered for the major offensive, it is essential that other military objectives be attained. In the Far East the control of the sea is essential. Japan has extended her operations to such a distance from the home land, that the success of its operations is wholly dependent upon its ability to maintain control of the sea in the Orient. Hence, the destruction of the Japanese fleet and its supports becomes a primary objective of all military forces. The destruction of an opposing fleet is normally a function of the Navy. A fleet must have nearby bases in order to operate. In the Orient the most suitable naval base is Singapore. Manila provides a secondary base. Mindanao at the extreme south tip of the Philippine Archipelago might eventually be built up as a base. Australia offers possibilities, but is somewhat distant from the theater of operations. The conclusion drawn from the above is that the preservation of Singapore in friendly hands is vital.

5. It would be of the greatest advantage to the fleet to operate with the support of shore-based air forces. Singapore itself offers some possibilities, but of a limited extent. The Philipping Islands on the Eastern flank of the South China Sea offer many possibilities for shore-based aviation. China on the western flank of the South China Sea might offer innumerable facilities if they can be secured and maintained. Operating from these three areas, the fleet could be well supported and could undoubtedly control the sea lanes leading to Saigon in French Indo China, to Siam, and to Upper Malaya. The secondary effect of this ring would be to curtail any outside resources of Japan.

6. The principal source of supply for the entire Japanese

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effort, land, sea, and air, is the industrial area located in the Japanese Islands and in that area of China which provides raw materials which are fabricated into munitions of war in Japan. The industrial area of Japan is fairly well centered on the Inland Sea. Tokyo, Yokahoma, and Nagasaki areas are also vital to the Japanese zone of the interior. A forced landing on the Japanese Islands would be extremely costly and long drawn out. The area can be attacked by air forces based on the Vladivostok area or the Korean area. Consequently, the home land of Japan becomes a vital target, second only in importance to the Fleet.

7. Summarizing the foregoing, Japan can be defeated if the following objectives are obtained:

(1) Control of the sea lanes, involving destruction of the Japanese Fleet and its supports.
(2) The defense of the Philippines to guarantee air bases for Air Force action and Secondary Naval Bases.
(3) The retention of Singapore as a primary naval base.
(4) The establishment of air bases in China for Air Force Operations.
(5) The destruction of the industrial resources located in the Japanese Islands.

It becomes apparent that the defeat of Japan is primarily dependent upon the success of the friendly fleet, and the operation of air forces both in support of the fleet and independent of it. Ground forces are essential to defend and to secure bases to support the air forces and the fleet, and to support air operations in Siberia and in China.

8. To accomplish any or all of the foregoing objectives inevitably produces the important factor of the maintenance of lines of communication. Until the fleet attains control of the sea lanes crossing the Pacific, that area becomes a defile subject to air and submarine attack. Its distance is great. There are few intermediate staging areas. To divert the fleet from its primary purpose of attempting to seek out and destroy the Japanese fleet might be fatal. For the moment, therefore, it appears as if any reinforcement and support to the Far East from the United States, will have to appear from some route other than across the Pacific.

9. The Philippine Islands must stand on their own for the time being. They can be reinforced with limited numbers of long range aircraft and such ground forces as can be transferred, provided this delivery does not divert major forces from the U. S. Fleet. The Siberian area would require the closest cooperation and support from the Siberian Army and Air Forces. If such support could be obtained, it is feasible to shift air forces by air to the Vladivostok area. These, however, would have to depend upon Russian resources for the time being to support their operations. At this time of the year, climatic conditions are severe in that area, and therefore this project might be delayed. Delay in the mean time might clarify the sea lane situation, and it is possible that Vladivostok could be reached with shipping from the west coast of the United States in sufficient quantity to make an air force self-sustaining.

10. The all important base at Singapore, which is so vital to the success of any operations, can and must be supported from the West. China, which is an ally, is hemmed in on its eastern coast. For the moment it is impossible to make any entry into China from that direction.

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entry from the north would be difficult due to climatic conditions at this time of the year. The only remaining entry into the interior of China is via the Burma Road. If the area of China is to be utilized by ground and air forces, it is essential that they be not only introduced into the area, but supported after their arrival. One thin line of communication which is vulnerable as soon as Japan occupies Siam makes this a dangerous adventure, and undoubtedly would eliminate the use of land or air forces except as a gesture.

11. There are many possibilities in the line of communication from Rangoon westward to the United States. Long-range aircraft can be flown across the South Atlantic, thence across Africa to India along established air routes. Shorter range aircraft ~~with the exception of fighters~~, can also be flown across Africa to India. Staging facilities are now in operation. Repair facilities exist in the Cairo Area, and will soon be in Eritrea in the Gura-Asmara area. An erection plant and repair facilities will soon be available in the Basra area. Preliminary surveys of Karachi and Calcutta indicate that similar facilities can be erected at those points. The sea lanes of the Atlantic Ocean, and the Indian Ocean are probably the least disturbed. Shipping therefore, is possible around the Cape of Good Hope to the ports of Massawa, Basra, Karachi, and Calcutta. It is assumed that shipping facilities and a suitable service can be obtained from Calcutta to Rangoon. It is therefore possible to support air forces in China via this route from the United States, but the distances and the time element involved should not be underestimated. However, at this point it is essential that it be realized that the entry into China is dependent entirely upon the security of the Burma Road. After entry into China there are innumerable difficulties, as local resources are practically nil in the interior. Every item required to support an air force must be imported, including complete medical service and food supplies. These factors are so difficult in the interior of China, that an American force would find it difficult to survive if they were forced to depend upon China's resources.

12. At the present time so little is known of the air facilities within the interior of China and the depth of Japanese occupation, that it would be impossible to state how far to the east air forces could be dispersed. If however, they can be dispersed within two hundred miles of the coast, the forces of reconnaissance and heavy bombardment would be extremely useful in support of air forces based on the Philippines and Singapore. These could support the fleet in the South China Sea and operate against bases at other ports of embarkation on the China coast.

13. All of the foregoing factors indicate that for immediate action against Japan, a difficult situation is presented primarily because of the logistical factor. Reverting to the opening paragraphs of this estimate, it again becomes evident that some other space must be found from which a major offensive designed to win the war can be launched which can be adequately supported in its logistical factor. A study of the map indicates without any question, that such an area exists in the Northern portion of Africa. The long sea lanes and lines of communication forced upon the Allies at this time are due primarily to the fact that the Mediterranean Sea and the Suez Canal are closed to traffic or are seriously interrupted. These sea lanes should and must be returned to Allied control. At the present time the Russian

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Army is successfully driving the German forces westward on the north shores of the Black Sea. If this operation continues to be successful, it eliminates or at least postpones, any campaign southward from the Caucasus Area. The British Army is at the present time engaged in an offensive in Libya, and has attained some success. If this effort can be supported vigorously, it would undoubtedly secure the north coast of Africa. When that is secured, it would automatically acquire the area now controlled by the Axis on the west coast of Africa. If that objective can be obtained, it would be possible to restore control of the Mediterranean, to launch an offensive against the territory of Europe through Spain, France, Italy, or the Balkans. The lines of communication from the United States would be reduced to such an extent as to make the logistical problem reasonable to handle. An air force of any size can be supported in northern Africa, Iran, and Iraq. It brings the vital target of Germany within reach of bombardment. A strong force operating from this area to the north and northwest, supported by a vigorous offensive from the British Isles, has a reasonable chance of defeating Germany and thereby winning the war.

14. Conclusions. From the foregoing estimate of the situation, it is concluded that the operations in the Far East should become in the nature of a strategic defense. Sea Power and such Air Power as can be delivered to the area should be utilized to destroy the Japanese Fleet and the Industrial area of Japan. Singapore, the Burma Road, and the Philippine Islands must be retained at all costs. The route from the United States to the Far East via Africa must be used for logistical support. Siberia must join the Allies actively.

The major and primary offensive must be launched from the Middle East. The American Army and Air Forces which are available after the minor reinforcement of the Far East garrisons should be sent immediately to reinforce the British effort in its Libyan campaign, with the view of ultimately taking over the entire area of North Africa, leaving to the British the Iran and Iraq area. No time should be lost in launching this campaign. Although the British are for the moment partly successful in their Libyan campaign, it would be fatal to have them defeated and thrown back again on the delta area of Egypt. The main effort must be aimed at Germany from the direction of the Middle East supported by an effort from the British Isles.

E. E. ADLER
Brigadier General, U.S.A.
Chief, the Air Section
U. S. Military North African Mission

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Sept 1941
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ARMY (2)

ESTIMATE

ARMY REQUIREMENTS

Prepared by:

WAR PLANS DIVISION
GENERAL STAFF

Sept...1941

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Army

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prepared by:

WAR PLANS DIVISION
GENERAL STAFF

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ULTIMATE REQUIREMENTS STUDY

ESTIMATE OF ARMY GROUND FORCES

1. The specific operations necessary to accomplish the defeat of the Axis Powers cannot be predicted at this time. Irrespective of the nature and scope of these operations, we must prepare to fight Germany by actually coming to grips with and defeating her ground forces and definitely breaking her will to combat. Such requirement establishes the necessity for powerful ground elements, flexibly organized into task forces which are equipped and trained to do their respective jobs. The Germans and their associates with between 11 and 12 million men under arms, now have approximately 300 divisions fully equipped and splendidly trained. It is estimated that they can have by 1943, a total of 400 divisions available in the European Theater.

2. The important influence of the air arm in modern combat has been irrefutably established. The degree of success attained by sea and ground forces will be determined by the effective and timely employment of air supporting units and the successful conduct of strategical missions. No major military operation in any theater will succeed without air superiority, or at least air superiority disputed. The necessity for a strong sea force, consisting principally of fast cruisers, destroyers, aircraft carriers, torpedo boats and submarines, continues in spite of the increased fighting potential of the air arm. Employment of enemy air units has not yet deprived naval vessels of their vital role on the high seas, but has greatly accelerated methods and changed the technique in their employment. It appears that the success of naval operations, assuming air support, will still be determined by sound strategic concepts and adroit leadership. A sea blockade will not accomplish an economic strangulation or

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or military defeat of Germany. Nor will air operations alone bring victory. Air and sea forces will make important contributions but effective and adequate ground forces must be available to close with and destroy the enemy within his citadel.

3. It is therefore imperative that we create the productive capacity to provide equipment for the following:

a. Appropriate forces distributed for the defense of the United States, outlying possessions and bases selected to facilitate the defense of the country and the Western Hemisphere.

b. Task Forces which can effectively conduct military operations, primarily in the European Theater, as well as in the Western Hemisphere and in other strategically important areas.

c. The military forces of associated and friendly Powers committed to the policy of opposing Nazi aggression. Quantities to be limited only by our own strategic requirements and the ability of the friendly Powers to use the equipment effectively.

4. A sound approach to the problem of determining appropriate military means requires careful consideration of MEANS, WAYS and MEN, they will be employed to defeat our potential enemies and to assist our associates.

a. MEANS. Accepting the premise, that we must come to grips with the enemy ground forces, our principal theater of war is Central Europe. Possible subsidiary theaters include Africa, the Near East, the Iberian Peninsula, the Scandinavian Peninsula and the Far East; however, the operations in those theaters must be so conducted as to facilitate the decisive employment of Allied forces in Central Europe.

b. WAYS. The combined and carefully coordinated operations of our military forces, in collaboration with associated Powers, must accomplish the following:

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(1) The surface and subsurface vessels of the Axis and associated Powers must be swept from the seas, particularly in the Atlantic and water areas contiguous to Europe.

(2) Overwhelming air superiority must be accomplished.

(3) The economic and industrial life of Germany must be rendered ineffective through the continuous disruption and destruction of lines of communication, ports and industrial facilities, and by the interception of raw materials.

(4) The combat effectiveness of the German military forces must be greatly reduced by over-extension, dispersion, shortage of materiel, including fuel, and a deterioriation of the Home Front. Popular support of the war effort, by the peoples of the Axis Powers must be weakened and their confidence shattered by subversive activities, propaganda, deprivation, the destruction wrought and chaos created.

(5) Existing military bases (the British Isles and the Near East) must be maintained. Additional bases, which encircle and close in on the Nazi citadel, must be established in order to facilitate air operations designed to shatter the German industrial and economic life. Such bases may also provide feasible points of departure for the combined operations of ground and air forces. In disposing of our forces, we must guard against dispersion of means in operations that do not make timely and effective contributions to the accomplishment of our main task, the defeat of Germany.

(6) The commitment of our forces must conform to our accepted broad strategic concept of active (offensive) operations in one theater (European), and concurrently, passive (defensive) operations in the other (Pacific).

d. TIME. The following factors with regard to the time element are important in determining the production capacity necessary to realize our national objectives:

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(1) The lag between plan and execution is considerable. Past experience indicates that from eighteen months to two years are required.

(2) How many months will Germany require to defeat Russia, to reconstitute her forces subsequent to Russia's defeat and to exploit to any perceptible degree the vast resources of Russia? It is believed that Germany will occupy Russian territory west of the general line; White Sea, Moscow, Volga River, (all inclusive) by July 1, 1942, and that militarily, Russia will be substantially impotent subsequent to that date. Thereafter, Germany will "Coventry" all industrial areas, lines of communications and sources of raw materials east of the line indicated, unless a drastic Nazi treaty is accepted by Russia. Germany will probably require a full year to bring order out of chaos in the conquered areas, so that it will be July 1, 1943, before she will largely profit economically by her "drive to the east." The maintenance of huge armies of occupation has become unnecessary. By totally disarming the conquered people, maintaining splendidly organized intelligence and communications nets, and employing strategically located, highly mobile forces (parachute, air-borne, mechanized and motorized), Germany may control the occupied areas with relatively small forces, thus releasing the bulk of the military for other tasks. Obviously, our war effort time-table, covering the production of munitions, the creation of trained military forces and the increase of transportation facilities (air, ground and sea), is strongly influenced by events transpiring in the Russian theater.

(3) We are confronted by two possibilities; first, a rapidly accelerated all-out effort with a view to conducting decisive, offensive operations against the enemy before he can liquidate or recoup from his struggle with Russia; second, a long drawn-out war of

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attrition. Under our present production schedule, we will soon have adequate military means to defend our outlying possessions and bases and to provide for the security of the Western Hemisphere, but we will not be able to provide sufficient appropriate forces for timely offensive action in the principal theater of operations. The urgency for positive action exists, particularly while the enemy is contained militarily in Russia. It would strongly contribute to the early and decisive defeat of the Axis Powers, if the Allied forces could seize and firmly establish military bases from which immediate air and subsequent ground and air operations might be undertaken.

(4) The United States is approaching its task in a logical manner, but the production of materiel must be greatly accelerated to permit its accomplishment. At present, the bulk of our production has to be devoted to the support of Great Britain and associates, rendering it impracticable for us to undertake offensive commitments. But time is of the essence and the longer we delay effective offensive operations against the Axis, the more difficult will become the attainment of victory. It is mandatory that we reach an early appreciation of our stupendous task, and gain the whole-hearted support of the entire country in the production of trained men, ships, munitions, and ample reserves. Otherwise, we will be confronted in the not distant future by a Germany strongly intrenched economically, supported by newly acquired sources of vital supplies and industries, with her military forces operating on interior lines, and in a position of hegemony in Europe which will be comparatively easy to defend and maintain.

(5) The time by which production can reach the levels defined by our national objectives is highly speculative. July 1, 1943, has been established as the earliest date on which the

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equipment necessary to initiate and sustain our projected operations can be provided. The ability of industry to meet this requirement is contingent upon many intangibles; however, the program can be definitely accomplished, in fact, greatly exceeded, if the industrial potential of the country is fully exploited. The urgency of speed and the desirability of employing our present great economic and industrial advantage over our potential enemies cannot be overemphasized.

4. Strategic Employment of Ground Forces.

a. The future alignment of Powers and their respective combat capacities cannot be accurately predicted. In order to arrive at a plausible basis from which to determine our future requirements, the following assumptions pertaining to the world situation as of July 1, 1943, are made:

(1) Russia is substantially impotent militarily in Europe. Resistance in Siberia, to include the Maritime Provinces, probably continuing.

(2) The Axis military strength is materially weakened through economic blockade; by losses in the Russian campaign, by British air and sea operations; by the inability to exploit quickly the extensively sabotaged Russian industries and raw materials; by lowered morale of the people.

(3) The military forces of Japan are fully involved with or contained by campaigns against a somewhat strengthened China, by the Russian forces in the Far East Maritime Provinces, or by the threat of United States - British military and economic reprisals.

(4) Great Britain and associates have increased their fighting forces by creating and equipping additional combat units.

(5) The French will probably continue their passive collaboration with Germany.

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(6) Control of the Mediterranean Theater, including North Africa and the Near East, remains disputed.

(7) The United States is an active belligerent and is collaborating in an all-out effort to defeat Germany.

b. If these assumptions are correct, or even reasonably sound, on July 1, 1943, there will be no military bases remaining in Allied hands, other than the United Kingdom, possibly the northern coast of Africa and the Near East. The establishment of additional bases, for example, in the Iberian Peninsula, the Scandinavian Peninsula and Northwest Africa will be bitterly contested by the Axis. However, to bring about the ultimate defeat of Germany, those bases and others even more difficult to establish, must be available to the Allies. Obviously, carefully planned action, involving appropriate sea, air and ground units must be undertaken. Allied success is directly contingent upon the coordinated employment of overwhelming forces, surprise and mobility, supported by sufficient reserves in materiel and man-power to insure a succession of effective impulses throughout the operations.

c. Latest information pertaining to the potential industrial capacities and military strengths of the opposing Powers, (excluding the U. S.) as of July 1, 1943, indicates that the Axis Powers will have about 400 divisions available in the European-Near East Theater and the Allied Powers approximately 100 divisions. To accomplish the numerical superiority, about 2 to 1, usually considered necessary before undertaking offensive operations, the Allies would have to raise about 700 divisions. A force of 700 divisions with appropriate supporting and service troops would approximate 22 million men. If Great Britain and the United States should induct so many men for military service, added to the tremendous numbers already under arms, the economic and industrial effort, necessary to conduct the

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war, would be definitely imperiled.

2. It is believed that the enemy can be defeated without creating the numerical superiority indicated. Effective employment of modern air and ground fighting machines and a tight economic blockade may create conditions that will make the realization of the Allied War Aims perfectly feasible with numerically less fighting men. Another million men in Flanders would not have turned the tide of battle for France. If the French army had had sufficient tanks and planes, and quantities of antitank and antiaircraft material, France might have remained a dominant power in Europe. In June, 1941, when the Germans launched their invasion of Russia, they knew that their adversary was numerically superior and could maintain that superiority in spite of tremendous losses. They probably also knew that Stalin was creating a military force of great power, consisting primarily of effective modern fighting machines, and that if they delayed their "drive to the east" another year, Russia would possess armadas of air and ground machines which would not only render an offensive campaign impossible, but would make large demands upon the German military to secure her western frontier. The Crete campaign also presents illuminating evidence in favor of modern fighting means when opposed by superior numbers that are equipped with inappropriate means and are operating under World War I tactical concepts. Approximately 17,000 Germans attacked and conquered the island which was defended by about 30,000 British.

3. Our broad concept, of encircling and advancing step-by-step, with a view to closing-in on Germany, will remain sound regardless of future developments in the European situation, for it envisages the only practical way in which military and economic pressure may be brought to bear effectively against Germany. The loss of potential bases of operation, presently available, would render the accomplish-

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ment of our strategic plans extremely difficult and costly. It is imperative, therefore, that the Allies take effective measures to hold the United Kingdom, the Middle East, and North African areas. Also the islands off the northwestern coast of Africa should be denied to the enemy. Before undertaking operations in connection with the establishment of additional military bases, for example, in the Scandinavian Peninsula, the Iberian Peninsula, Africa and the Low Countries, a careful survey of the areas of projected operations and a thorough examination of the enemy capabilities are mandatory. The unfortunate Norway campaign of 1940 is a glaring example of a total lack of appreciation of such realities on the part of those responsible for the British expedition. The Germans employed approximately 175,000 men, strongly supported by the Air Force, to conquer and secure their lodgement in Norway. Special Task Forces, including two mountain divisions and numerous parachute units made effective contributions to the success of the operation. Having gained a foothold, the Germans quickly established themselves in order to hold their bases and to facilitate exploitation. The British Forces despatched against Norway totalled about 24,000 men with no mountain troops and with inadequate air supporting units. The failure of the British Expedition is directly attributable to insufficient and inappropriate means. If and when the situation indicates the feasibility of an Allied expedition, against Norway for example, powerful and appropriate means, especially trained and equipped for the task, must be provided. Large and effective reserves must be readily available to preclude dislodgement of the initial forces and to facilitate subsequent exploitation. A careful study of Norway, including the terrain and communications net, and a survey of possible enemy capabilities, indicate the necessity for mountain, infantry foot and motorized divisions, numerous

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parachute, tank, anti-tk, antiaircraft and air-borne units. The force required for the entire operation may total several hundred thousand men. The execution of the plan would be predicated on sea and local air superiority. The size of this force may appear large. However, even though our enemy may not be strong initially in the area of projected operations, the mobility of modern fighting means will enable him to concentrate destructive forces against us with unprecedented speed and surprise effect. The foregoing considerations apply with equal emphasis to proposed forces for other theaters of operations. Careful studies, concerning the Scandanavian Peninsula, the Iberian Peninsula, the Near East and Africa, have been made by the War Plans Division of the General Staff, and these studies made important contributions in the determination of the estimated Ground Forces (See Tab A). The enemy capabilities in those theaters in 1943 would obviously be conjecture. Task Forces consisting principally of armored and motorized divisions, must be created for possible operations in North Africa, the Middle East, France and the Low Countries. The exact strength and the composition of the Task Forces, necessary to seize and maintain military bases, will be determined immediately prior to the operation. We can avoid the unfortunate disasters experienced by our potential allies in Norway, France, the Balkans and in Crete by planning now and creating quickly the production capacity necessary to equip the ground forces recommended (Tab A). We must not suffer ignominious defeat and be expelled from the bases that we elect to establish. If the premises and assumptions made earlier in this study are appropriate and sound, additional strategically located bases are vital to the splendidly conceived plans of the Air Force and finally may serve as areas of departure for the combined operations of air and ground forces. The seizure, retention, and effective utilization of these bases is predicated on the successful operations of adequate sea, air and ground forces.

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5. Shipping was a bottleneck in the last war and again increased demands will be placed on all transportation facilities, particularly water, by constant troop movements and the expanded war industrial and economic effort. In order to transport and maintain effective forces in European areas, several million tons of shipping and adequate port facilities must be made available essentially for military service. To transport five million men with their modern air and mechanized equipment to European ports over a period of approximately one year would require about seven million tons of shipping or 1,000 ships. To maintain such a force in the theater of operations would require about ten million tons of shipping or 1,500 ships. But it is highly improbable that the situation in Europe will develop in such manner as to permit or to require operations involving the movement of so large a force across the Atlantic within the limited time of one year, even if the ship tonnage were available. The progressive building-up of large military forces in the theater will probably extend over a period of at least two years. This progressive movement would greatly reduce the demands upon maritime shipping for essentially military purposes and further would extend the period of time for the augmentation of maritime shipping now available. The realization of our present national policies may require operations in distant theaters by military forces of unprededented strength. It would be folly to create strong fighting forces without providing the transportation to move and maintain them in the contemplated theaters of operations. The maximum possible shipbuilding capacity of our country, coordinated of course with other essential demands upon industry and raw materials, must be exploited and continued in operation for the next several years.

6. The foregoing considerations clearly indicate the importance of creating a productive capacity in this country, that will provide

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the most modern equipment designed to give mobility and destructive power to our striking forces. The forces that we now estimate as necessary to realize our national objectives and for which production capacity must be provided, may not be adequate or appropriate. No one can predict the situation that will confront the United States in July, 1943. We may require much larger forces than those indicated below, and correspondingly greatly increased quantities of equipment. Emphasis has been placed on destructive power and mobility, with a view to offensive maneuvers in our principal theater of operations (Europe). The forces deemed necessary to accomplish the role of ground units in the supreme effort to defeat our potential enemies, total 5 Field Armies consisting of approximately 215 divisions (infantry, armored, motorized, air-borne, mountain and cavalry) with appropriate supporting and service elements. The strategic concept outlined in this paper contemplates distribution of U. S. ground forces approximately as follows: (More specific data will be found in Tab A).

Iceland	29,000
Scotland	11,000
England	41,000
Ireland	25,000
Puerto Rico	34,000
Panama	42,000
Alaska	29,000
Philippine Islands	25,000
Smaller Outlying Bases	32,000
Potential Task Forces	
First Army	775,500
Third Army	590,000
Fourth Army	710,000
Brazil	86,000
Colombia - Ecuador - Peru	37,000
Total	2,500,000
Strategic Reserves for which production capacity must be established but whose activation, location and training will be determined by developments in the international situation.	3,000,000
Troops in the Zone of the Interior and Fixed Defense Units (Ground)	1,200,000
TOTAL GROUND FORCES	6,700,000

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TAB A

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The Ground Forces estimated as necessary to provide for the security of the U.S. outlying possessions, the Western Hemisphere and to make available appropriate forces for projected military operations follow:

1. Units organized, fully equipped and trained as soon as practicable:

a. Military Bases and Outlying Possessions.

Newfoundland	5,090
Greenland	2,531
Caribbean Bases	40,190
Puerto Rico	34,757
Panama	42,614
Hawaii	61,337
Philippines	22,997
Alaska	23,723
Iceland	21,709
Bases in British Isles	74,150
	343,217

b. Potential Task Forces

Brazil

1 Army Corps (1 Div. Inf, 1 Div. Air-Borne)	42,392
2 Artillery Battalions Pack	1,804
1 Cavalry Regiment	1,521
3 Parachute Battalions	2,590
1 Antiaircraft Regiment and 2 Medium Battalions	3,919
2 Aircraft Service Squadrons	2,600
2 Tank Battalions (Light)	1,080
3 Anti-Tank Battalions	2,190
Services	22,254
Total	80,340

Colombia-Ecuador-Peru

1 Division	15,345
2 Artillery Battalions	1,400
3 Parachute Battalions	1,554
1 Antiaircraft Regiment and 2 Medium Battalions	3,919
2 Tank Battalions (Light)	1,080
1 Aircraft Service Squadron	1,200
Services	13,035
Total	37,439

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First Army

1 Army consisting of 3 Corps of 3 Divisions ea.	242,216
2 Armored Corps consisting of 2 Armd Div. ea.	53,556
8 Divisions (4 Mtzd, 2 Mountain, 2 Air-borne)	108,816
5 Paracnute Bns.	2,390
13 Artillery Bns. (4 heavy, 6 (105mm), 3 (75mm How Pk)	9,906
20 Antiaircraft Regts and 10 extra Bns. 37mm	46,970
11 Tank Battalions (3 Medium and 5 Light)	4,839
12 Aircraft Warning Regts	15,600
10 Tank Destroyer Bns; and 10 anti-tank Bn (Gun)	14,000
Services (Ord., QM, Sig., Engr., Med.)	278,069
Total	776,262

Third Army

1 Army (3 Corps, 9 Divisions)	242,216
1 Armored Corps (2 Divisions)	28,778
2 Divisions Motorized	38,258
6 Artillery Battalions (Medium & Heavy)	4,300
1 Cavalry Corps and 2 M-Recz Regiments	25,867
2 Air-Borne Division s	20,000
5 Parachute Battalions	2,590
5 Antiaircraft Regiments and three medium Bns.	12,166
3 Aircraft Warning Regiments	3,900
15 Tank Destroyers or Anti-Tank Battalions	10,500
Services	207,860
Total	589,435

Fourth Army

1 Army (3 Corps, 9 Divisions)	242,216
1 Armored Corps (2 Divisions)	25,394
4 Division s, Motorized	64,516
8 Artillery Battalions (Medium or Heavy)	8,800
4 Divisions (2 Mountain, 2 Air-borne)	44,000
2 Parachute Battalions	1,036
15 Antiaircraft Regiments and 10 Medium Bns.	37,345
8 Tank Battalions (Medium or Light)	4,839
6 Aircraft Warning Regiments	7,800
25 Tank Destroyers or Anti-Tank Battalions	17,500
Services	256,413
Total	709,859

Total Task Forces 2,199,441

2. The troops considered necessary in the ground forces, i.e. organized, fully equipped and trained, for current and future employment as security forces in military bases and outlying possessions, and as striking forces in any theater, follows:

Military Bases and Outlying Possessions	346,217
Potential Task Forces	2,199,441
Total	2,545,658

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2. Production capacity should be created to equip approximately 3 million for the reserve units indicated below. Activation, location and training of these units will depend upon the international situation.

1. Strategic Reserves.

2 Armies (10 Army Corps, 27 Divisions)
14 Armored Corps (53 Armored Divisions)
51 Divisions Motorized
115 Artillery Battalions, (Pack Medium or Heavy)
9 Divisions (2 Cavalry, 6 Mountain, 3 Air-Borne)
22 Parachute Battalions
129 Antiaircraft Regiments and 133 Medium Bns.
86 Tank Battalions (70 Medium, 6 Light, 10 Heavy)
29 Aircraft Warning Regiments
290 Tank Destroyer Battalions
262 Anti-Tank Battalions (Gun)

Total - approximately	3,000,000

3. Ground troops required for the Zone of Interior and Fixed Defense Units 1,200,000

4. Recapitulation of Ground Forces

Military Bases and Outlying Possessions	346,217
Potential Task Forces	2,199,441
Zone of Interior - Fixed Defenses	1,200,000
Total	3,745,658
Units in reserve to be activated when situation requires	3,000,000
Total Army Ground Forces	6,745,658

5. Air Force requirements (details submitted in a separated study)

Air Force Combat	1,100,000
Zone of Interior Service Units	950,000
Total Air Force	2,050,000

6.

Army Ground Forces	6,745,658
Army Air Forces	2,050,000
TOTAL ARMY FORCES	8,795,658

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I. AIR ESTIMATE OF THE SITUATION ,Etc. Dec 8 '41 Copy No. 2

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Copy 1
8 Dec 1941

2859-58

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No. 2.

AIR ESTIMATE OF THE SITUATION

as of 7:00 AM, Dec. 8th,

1941.

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MEMORANDUM FOR THE CHIEF OF STAFF:

Subject: Air Estimate of the Situation - 6:30 a.m. December 8.

I. SITUATION.

1. The Japanese air attack on the U. S. Fleet at Pearl Harbor, which leaves only one U. S. Battleship in commission there, has reversed the balance of sea power in the Pacific, with the following effects:

a. Our West Coast is exposed to carrier based air attack. The aircraft industries at San Diego, Los Angeles and Seattle, which are absolutely vital to our war effort, are now exposed to attack from the air.

b. Reinforcement of our garrison in the Philippines by sea across the Pacific is not only extremely hazardous, but probably impracticable.

c. Reinforcement of our garrison in Hawaii by sea will also be a hazardous undertaking.

d. The Islands of Hawaii are no longer provided protection by our sea forces, and are in serious danger of reduction or capture.

e. The Island stepping stones by which we planned to ferry aircraft to the Philippines are no longer secure.

f. The balance of sea power throughout the world is upset. The British Fleet is widely dispersed. The German battleships Tirpitz, Scharnhorst, Gneisenau, and Scheer may be expected to resume operations in the North Atlantic. The French Fleet may join this force. The sea lanes of the North Atlantic are exposed, and even our garrison in Iceland is threatened. Our naval forces in the Atlantic are inadequate. Our aircraft and munitions industry in New York and New England are exposed and vulnerable to attack by air if the aircraft carriers of the French fleet are employed by our enemies.

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2. The Japanese air attack on the Army Air Forces in Hawaii leaves that important base without adequate air defense. The bases may not be tenable, and reinforcements sent there may be lost. There are inadequate pursuit defenses, and there are practically no patrol forces, which are needed to make our bomber striking forces effective.

3. The garrison in the Philippines is small and very seriously threatened. Present strength: 35 B-17 bombers with reduced maintenance crews; 105 P-40 pursuit; 52 P-35 pursuit (serviceable). The attack on Clark Field may have destroyed some of this force. There are 52 dive bombers en route but their arrival is problematical.

4. Japanese air operation against Singapore greatly reduces the likelihood that the British can render assistance to the Philippines.

5. The drastic loss of American naval power resulting from this air attack leaves the Western Hemisphere seriously exposed - especially South America. If English resistance crumbles, a victorious Germany could cross the South Atlantic at will. NATAL IS VITAL TO OUR DEFENSE.

6. Conclusion.

1. Our West Coast must be protected against carrier attack by Pursuit and by seaward air reconnaissance patrol backed up by air striking forces.

2. The problem of air defense of our North Eastern industrial area and the North Atlantic has become acute.

3. The defense of Hawaii will require immediate air reinforcements.

4. If the integrity of the Philippines is to be preserved, they must be reinforced by bombardment and pursuit aircraft. If this is to be accomplished, the eastern ferry route via Natal, Africa, India, and Singapore must be utilized.

5. Sea power is no longer reliable as a primary instrument of American defense. Air power must replace it as the principle means of defense, and must be given first priority for production, including Defense Aid and the taking over of foreign contracts.

II. LINES OF ACTION.

1. Open to the enemy.

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a. Reduction of Hawaii by invasion.
b. Neutralization of Hawaii, by air attack.
c. Destruction of our West Coast aircraft industries.
d. Attack of the Philippines by air, sea, and land forces.
e. Air attack of certain vital points in our North Eastern aircraft industry, by carrier based aircraft.
f. Continue attacks against Singapore.
g. Attack the Panama Canal.

2. Open to us. (Air)

1. Defend the West Coast.

a. By Pursuit
b. By seaward air patrols and air striking forces.

2. Defend the East Coast.

a. By Pursuit.
b. By seaward air patrols and air striking forces.

3. Reinforce Hawaii.

a. With bombardment.
b. With pursuit.

4. Establish American Army forces at Natal.

5. Reinforce the Philippines.

a. With bombardment.
b. With pursuit.

6. Maintain defenses in Panama.

a. By pursuit.
b. By seaward patrol.

III. RECOMMENDATIONS.

1. That aircraft scheduled for Hawaii and the Philippines be retained in the United States and placed in operating units, and that our pursuit and bombardment forces be disposed to defend our vital establishments as follows:

a. West Coast of the United States and Alaska.
b. East Coast of the United States.
c. Panama.

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2. That the B-17 units on the West Coast be prepared for immediate dispatch to Hawaii if the situation indicates that some of them can be effectively employed there, the threat to the West Coast is dissipated, and the Navy can provide protection for vessels transporting pursuit.

3. That steps be taken immediately to expedite the movement of bombardment and pursuit units to the Philippines via the Eastern Ferry Route as soon as units become available after providing for 2 and 3 above.

4. That the defense of Panama be continued at present strength.

5. That United States Army troops be sent to Natal.

6. That all Defense Aid and foreign contracts aircraft be retained for the United States Army Air Forces until sufficient aircraft are available to provide the following strength in the Western Hemisphere and the Philippines and meet training requirements.

15 Groups of Pursuit at 2nd Aviation strength.
12 Groups of Bombardment (H) at 2nd Aviation strength.
2 Groups of Bombardment (M) at 2nd Aviation strength.

For details see Tab D.

NOTE: Immediate movement of the P-40 and B-26 airplanes, now being winterized at the Sacramento Depot to Alaska.

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TAB D

MINIMUM FORCES NEEDED IMMEDIATELY

Dispostion of forces needed immediately.

All units at 2nd Aviation Strength.

I. Heavy Bomber Groups.

1 Group Lost Angeles - San Diego.
1 Group Seattle.
1 Group San Francisco.
1 Group Newfoundland.
1 Group New England.
2 Groups Hawaii
2 Groups Philippines
1 Group Iceland
1 Group Panama.
1 Group Alaska.
12 Groups total.

II. Medium Bomber Groups.

1 Group North East
1 Group South East
1 Group North West
1 Group South West
1 Group Puerto Rico
1 Group Trinidad
2 Groups Brazil
8 Groups Total.

III. Pursuit Groups

1 Group San Diego
1 Group Seattle
1 Group San Francisco
2 Groups North East
1 Group Newfoundland
1 Group Iceland
1 Group Panama
1 Group Puerto Rico
2 Groups Hawaii
2 Groups Philippines
1 Group Alaska
1 Group Brazil
15 Groups Total.

TAB "A"

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CYPRUS PLAN

FILE NO.
145.81-4
25 Sept 42
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Headquarters,
ALLIED AIR FORCE
APO 923

MOST SECRET.

25th September, 1942.

CYPRUS PLAN.

The Cyrpus Plan involves a concentration of majority of Allied Air Force units in the New Guinea and York Peninsular Areas. The intention of the Plan is to accomplish the following :-

(a) Maintain air superiority over New Guinea.

(b) Bring a maximum amount of harassing effect upon enemy installations in New Guinea.

(c) Provide adequate protection of New Guinea bases for large scale topping-up of bombardment, and permit bombardment aircraft to be stationed thereat when desirable.

2. The strategical necessity for such a concentration has been apparent since May, 1942. It has not been until this time that sufficient airdromes have been completed to permit such a concentration. Although this is a separate Air Force measure it is in reality the accomplishment of the preliminary phase of the Tulsa Plan.

3. The following facilities exist for this concentration :-

(a) Port Moresby Area.

A total of seven airdromes, five of which are all-purpose dromes, of which three are being especially prepared to receive heavy bombardment. Adequate anti-aircraft for airdrome protection has been installed. An efficient permanent fighter sector and aircraft warning service exists. An ample supply of ordnance requirements, fuel, torpedo servicing, and other supplies are being currently provided.

(b) Milne Bay.

One strip has been prepared and is in use and two others are under construction. One of these additional strips will be finished by October 7th., and will be suitable for heavy bombardment. Sufficient anti-aircraft has been provided. A mobile fighter sector is now being formed and an adequate aircraft warning service has already been installed. A torpedo maintenance unit exists. Adequate ordnance requirements and fuel supplies are currently being supplied.

(c) York Peninsular.

Airdromes are now being constructed, are usable for dry weather operations now and are being surfaced for all-weather use by October 15th., at Horn Island, Iron Range (Portland Roads), Cooktown, Cairns, Mareeba and Townsville Area. A mobile fighter sector and aircraft warning service is provided at Horn Island and Townsville. Adequate anti-aircraft has been installed at each location. Ordnance and fuel stocks are being built up at each location.

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(d) At all points sufficient servicing units are being located to provide usual Air Corps maintenance facilities. A sub-depot is being provided at Port Moresby. All units are moving at full working strength wherever possible and in most instances full T.B.A. equipment is being taken less certain vehicles.

4. The movements incident to the Cyprus concentration are currently in progress. Land Force movements have priority over Air Force movements. It is anticipated that the Cyprus concentration will be effected on or about October 7th.

5. Hazards to the concentration :-

(a) Only eight minutes warning is available against enemy straffing attacks on Port Moresby.

(b) Docking facilities are scarce in New Guinea and York Peninsular, and adequate supply of units is difficult.

(c) A minor threat by enemy land action against out-lying airdromes at Port Moresby exists.

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49 Fighter Group
HQ - 8 F SQ (P40)
Available for one heavy ------ LALOKI -- 14
SQ

38 Bomb Gp (M)
HQ-71-405 SQ (B25)
75 Fighter SQ RAAF
(P40)
6 GR SQ RAAF
HQ-Flight (HUD)
RAAF Mobile F Sector
No. 1
450 Service SQ
R&D No. 15 RAAF

Topping up B-25's
Available for one heavy
SQ
Available for one
fighter SQ

-------- RORONA -- 30

WAIGANAI -- 20
:
:
9 F SQ of 49 F Gp (P38)
Available for one heavy
SQ
Available for flight
heavy Recce

--------- HORN IS
ISLAND

----- RED
ISLAND

43 Bomb GP (H) (B17)
HQ-63-64-65-403 B SQ
22 Bomb GP (M)
Adv. HQ-19-33- B SQ
(B26)
350 Service SQ

PORTLAND ROADS ---- : :

COOKTOWN
:
: --- COOKTOWN
Btry H, 94 CA (AA)

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Group
Q (F40)
or one heavy ------ LALOKI -- 14

BOMONA --12 ------ 80 F Sq of 8 F GP (F39)
8 Photo Sq (F-4's)

MORESBY.
8 Service Group
HQ-11-374-800 S S

WAIGANAI -- 20
:
:
9 F Sq of 49 F Gp (P38)
Available for one heavy
SQ
Available for flight
heavy Recce

SEVEN -- 7
:
:
35 Fighter Group
H - 39 F SQ (P38)
Topping-up for B-17's
and B-26's
Available for one Heavy
Sq.
RAAF TORP. Unit No. 2

WARD'S ------: 22 Bomb Sq RAAF (A20)
DROME -- 11 : 30 LRF Sq RAAF (BFR)
Flight 6 GR Sq RAAF (
41 F SQ of 35 F GP (P
Sup-Depot, U.S.A.
R.S.U. RAAF

MORESBY
CA (AA) W
Sn 208 CA (AA) W
Sn 209 CA (AA) Fa4A
ar A,B,C and
eries A and B 208 CA
A)
eries C and D 208 CA
A)
ery 2, 208 CA (AA)
nd 709 Sqns, Fortre
A)(Airborne)

THREE -- 3
:
:
3 Bomb Group
Adv. HQ-89 B Sq (A20)
7 F Sq of 49 F GP(P40)
Transport Command.

36 F Sq of 8 F GP (F39)
Available for one med. :
SQ :

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MORESBY.
8 Service Group
Hq-11-374-800 S Sq

CYPRUS CONCENTRATION

NEW GUINEA STATIONS AT DISCRETION OF C.G. ADV. HQ 5th AF.

WARD'S DROME -- 11 :
22 Bomb Sq RAAF (A20)
30 LRF Sq RAAF (BPB)
Flight 6 CR Sq RAAF (HUD)
41 F Sq of 35 F GP (P39)
Sup-Depot, U.S.A.
R.S.U. RAAF

THREE -- 3
:
:
3 Bomb Group
Adv. Hq-89 B Sq (A20)
7 F Sq of 49 F GP(P40)
Transport Command.

36 F Sq of 8 F GP (P39)
Available for one med. Sq : 2

FALL RIVER -- : 3
Flight 435 Recce Sq (B17)
Available for one med. Sq

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CAIRNS
:
: --- 49 Fighter Control SQ
11 and 20 FB SQ RAAF

MAREEBA :
:
19 Bomb GP (H)
HQ-28-30-93 B SQ (B17)
61 Service Squadron

GARBUT --- Flight 435 R
(B-17)
100 GR T SQ R
40 F SQ of 35
Aircraft Depo
USN Mobile To

REID
RIVER --

CHARTERS
TOWERS --

TORRENS CREEK
.....
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..... BREDDAN

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Fighter Control Sq
and 20 FB Sq RAAF

GARBUT --- Flight 435 Recce Sq
(B-17)
100 GR T Sq RAAF (Bft)
40 F Sq of 35 F GP
Aircraft Depot
USN Mobile Torp. Unit

REID 22 Bomb GP (No A/C)
RIVER -- H.-2-408 B Sq

CHARTERS
TOWERS -- 3 Bomb GP
H.-8-13-90 B Sq
(13 has A/C-B25)
47 Service Squadron

.....
. .
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..... BREDDAN

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HQ-35-SFC
49 Service SQ
RAAF TORF. UNIT No. 1
AVAILABLE for ONE MED.
SQ.

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100°
110°
120°
130°
20°
10°
0°
10°
20°
30°
40°
SIAM
ANNAM
PHILIPPINE ISLANDS
SUMATRA
BORNEO
CELEBES
AUSTRALIA
SINGAPORE
DARWIN
PERTH
Bangkok
Saigon
Manila
Cebu
Batavia
Macassar
Banjermasin
Balikpapin
Pontianak
Palembang
Medan
Penang
Kota Bharu
Natuna Is.
Anambas Is.
Sunda Is.
Timor
Arafura Sea
Timor Sea
Java Sea
Celebes Sea
Sulu Sea
Gulf of Carpentaria
Great Sandy Desert
Great Victoria Desert
Nullarbor Plain
Simpson Desert
Tanami Desert
Gibson Desert
Great Australian Bight
Eyre Peninsula
Spencer Gulf
Gulf St. Vincent
Lake Eyre
Lake Torrens
Lake Frome
Lake Gairdner
Lake Amadeus
Lake Mackay
Lake Macdonnell
Lake Callabonna
Lake Blanche
Lake Gregory
Lake Disappointment
Lake Barlee
Lake Carnegie
Lake Cowan
Lake Moore
Lake Grace
Lake Bryde
Lake Hope
Lake Yeo
Lake Ballard
Lake Darlot
Lake Wells
Lake Rason
Lake Lefroy
Lake Miranda
Lake Nash
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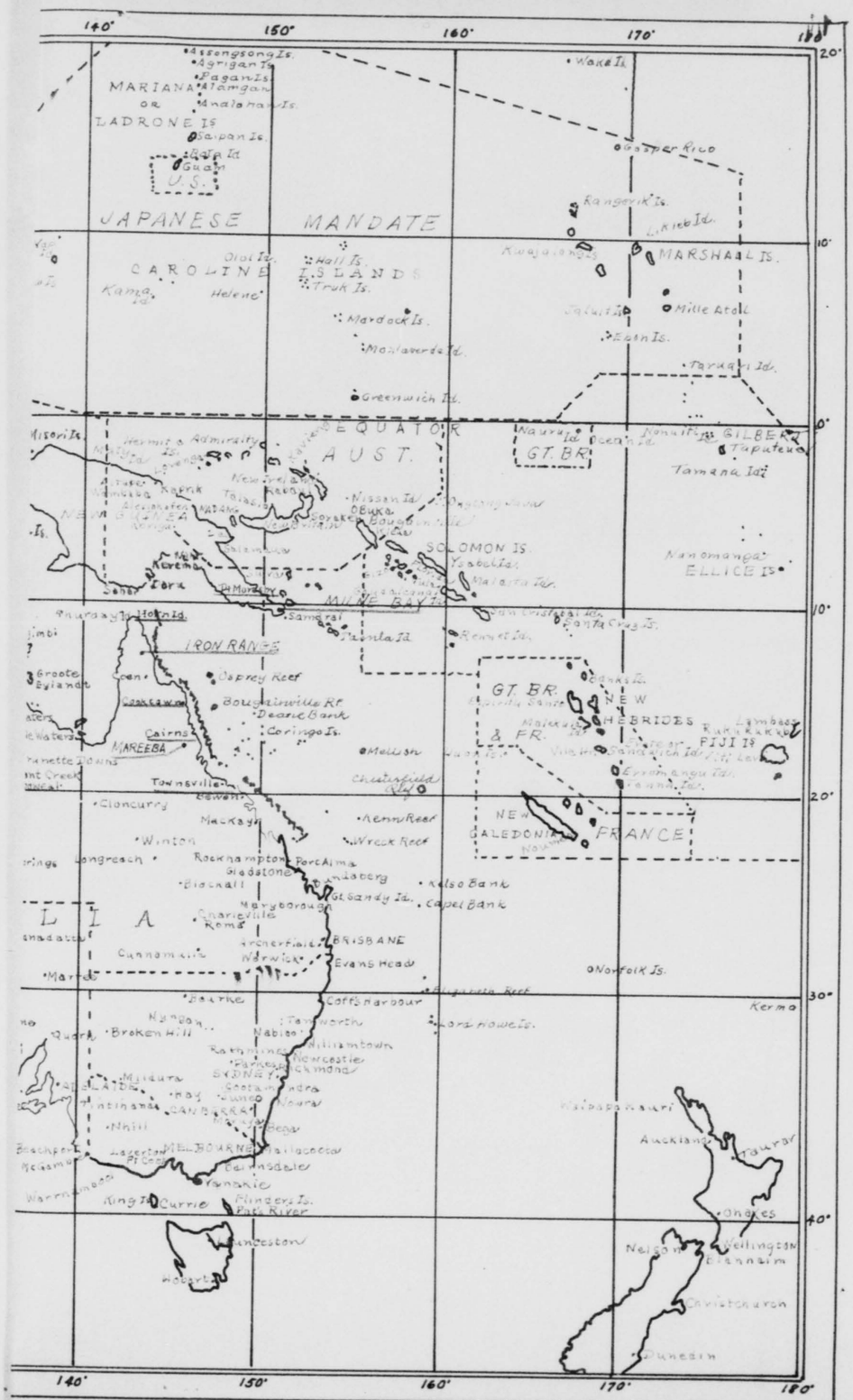

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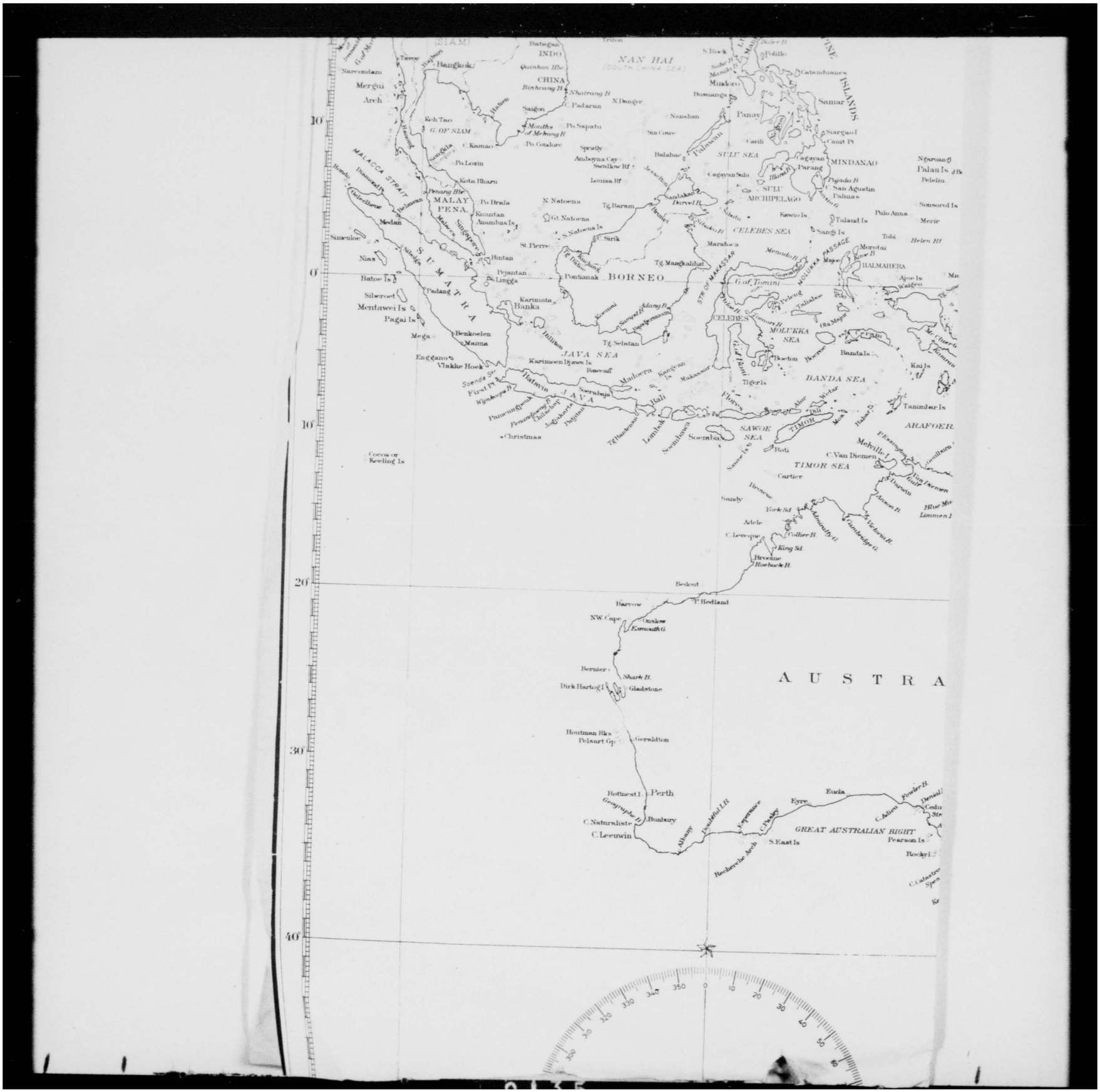
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Bernier I
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Pelsart Gp
Geraldton
Rottnest I
Perth
Bunbury
C. Naturaliste
C. Leeuwin
Albany
Eucla
Eyre
Esperance
C. Pasley
S. East Is
GREAT AUSTRALIAN BIGHT
Pearson Is
Rocky I
Recherche Arch
Finders B
C. Adieu
Ceduna
Streaky B
Spencer G
Yorke Pen
Gulf St Vincent
Kangaroo I
Encounter B
Lacepede B
Guichen B
Nuyts Arch
Great Australian Bight
Duntroon
Canberra
Victoria R
Armer B
Blue Mud Bay
Limmen I
Van Diemen Gulf
Port Darwin
Bathurst I
Melville I
Groote Eylandt
Wessel Is
Arnhem B
Gulf of Carpentaria
Cape York Pen
Torres Str
Thursday I
Prince of Wales I
Booby I
Raine I
Willis Is
Lihou Reef
Coral Sea
Gt Barrier Reef
Capricorn Chan
Swain Reefs
Fraser I
Sandy I
Hervey B
Bundaberg
Brisbane
Moreton B
Stradbroke I
Point Lookout
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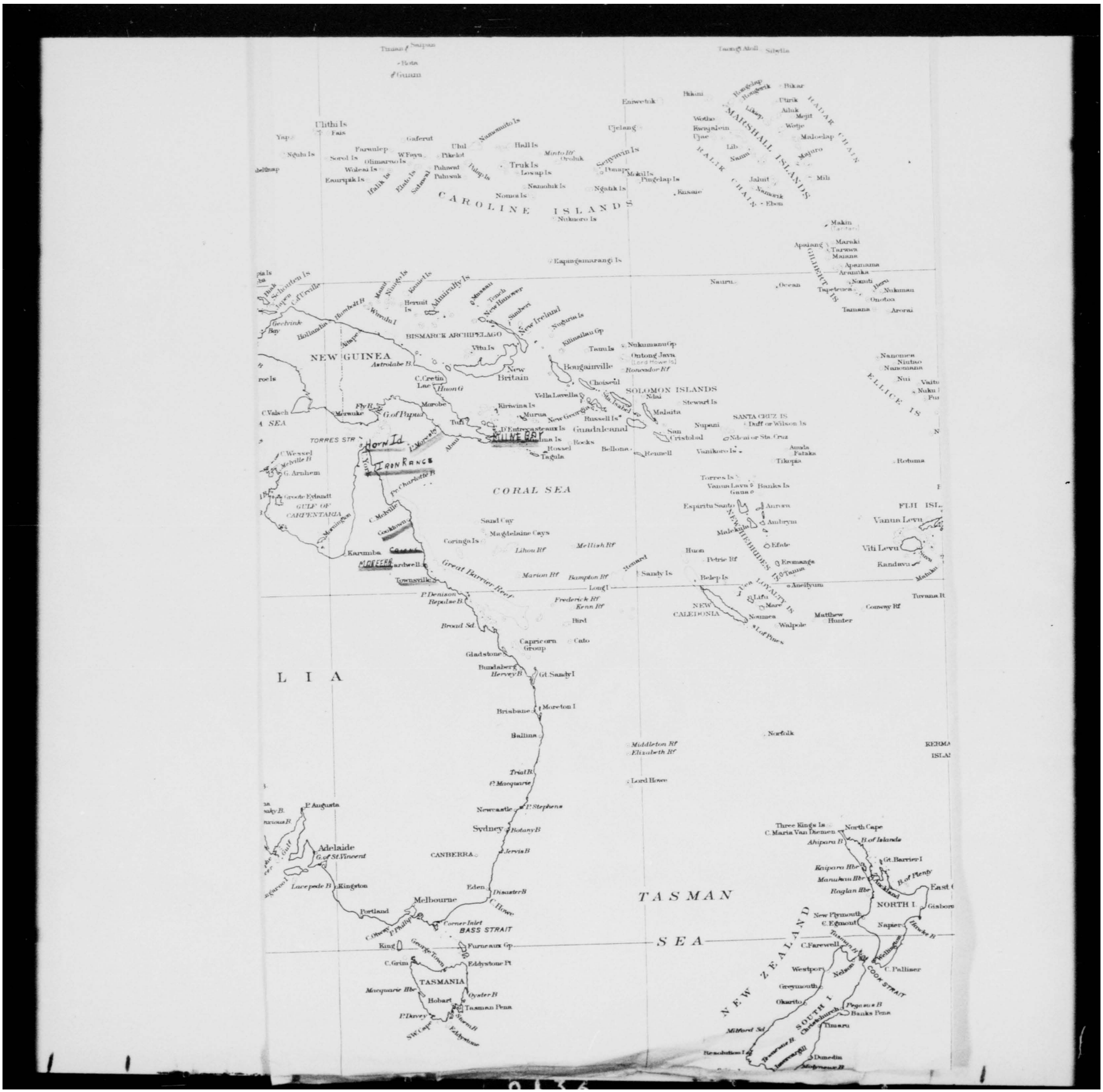

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Command of U. S. Forces /17/
In Caribbean (Syn AG ltr)

FILE NO.
145.81-5
15 Nov 1941
TO THE ARCHIVES
OF THE AAF
HISTORICAL OFFICE

3651-10

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CARRIBEAN DEFENSE COMMAND

(Secret) Letter A G 320.2 (11-8-41) MC - E - M

SUBJECT: Command of U. S. Army Forces in the Caribean.

Dated November 15, 1941

TO : Chief of Staff GHQ

SYNOPSIS

1. GHQ assumes command Carribean Defense Command effective December 1, 1941 (plus any other troops in Carribean Theatre).
2. Administration and Supply (except Air Corps technical) to remain temporarily as is and eventually change to C G C D C.
3. The Chief, Air Service Command, is responsible for Air Corps Technical supply of all air units in the C D C.
4. The C G C D C will call directly on the C/S G H Q for air reinforcements in case the need therefor arises.

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ACTIVATION OF
GREENLAND BASE COMMAND /27/

FILE NO.
145.81 -6
26 Nov 1941
TO BE KEPT PERM. IN THE ARCHIVES OF THE AAF HISTORICAL OFFICE

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DOD DIR 5200.9, 27 Sep 58

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Chief of the Army Air Forces
(5)

WAR DEPARTMENT
The Adjutant General's Office
Washington .Nov. 26, 1941

AG 320.2 (11-5-41)MC-C-M

Subject: Activation of the Greenland Base Command.

To: Chief of Staff, GHQ;
The Commanding General, 2d Corps Area;
The Commanding Officer, Greenland Base Command;
Chiefs of Arms and Services;
Divisions of the War Department General Staff.

1. The military garrison established in Greenland is designated as the Greenland Base Command, United States Army, under the command of GHQ.

2. No change will be made in existing arrangements for construction, supply, and administration.

By order of the Secretary of War:

E. L. Adams

Major General,
The Adjutant General.

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FILE NO. 145.81-7
14 Nov 1941
TO BE RETURNED TO THE ARCHIVES OF THE AAF PICTORIAL OFFICE

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SYNOPSIS

JAMAICA DEFENSE PROJECT

Approved, November 14, 1941

SECTION I - Scope

Tentative outline of personnel and material to defend U.S. Military and Naval establishments in Jamaica, including plan of employment.

SECTION II - Estimate of the situation

1a. Purpose of acquisition

To provide an additional secure fleet anchorage in Guantanamo area. (Joint Plan Con. Report 8-28-40)

b. Mission

(1) To defend United States military and naval installations in Jamaica against sea, land and air attacks.

(2) To cooperate with British in planning defense of Jamaica.

2. Geography

General - 142 x 54 miles. 4540 square miles.

Strategic value - Value as fleet base and base for wider dispersion of Air Forces in Carribbean area.

Terrain - Generally mountainous with plains near sea. Numerous small harbors, anchorages and beaches offer landing opportunities and make defense difficult.

Climate - Temperature and rainfall varies.

Airplane landing facilities - OK for seaplanes in Kingston Bay. Palisades (across bay from Kingston) Jamaica Government airport - 2 runways 3000 feet. Pan America has seaplane anchorage at Harbor head, 4 miles southeast of city.

Transportation - Rail - 210 miles standard gauge along main shore line. Roads - 2479 miles of macadamized and 2110 miles of other roads suitable for light motor traffic.

Communications - Telephone, Telegraph and Post Office 294 Post Offices of which 60 are telegraph and 146 are telephone offices.

Cable - With all parts of the world. West Indies and Panama Telegraph Co. Ltd.

Radio - Transmitter and receiver operated by West Indies and Panama Telegraph Co. Ltd.

3. The Enemy-

a. Forms of hostile attack

Sabotage, air bombardment, air raids from carriers, naval raids and bombardment.

4. Our own force -

a. Peace garrison (approved 8-11-41) Headquarters; Comp Inf. Co; Btry CA 155 mm; Sect. Btry. SL 155 mm; Btry 37mm Gun AA; Det. AWS; Airways Det. AC; Det. Sig. Ser; Det. Med. Sta Hosp; Det ORD; Det. Fin; Det. QM. Total 44 officers 831 EM.

b. Initial forces (TUNA) to leave United States November 17,1941 Hq; part Comp Inf. Co. (Co. Hq, 2 Rifle PL, 1 weapon PL, 1 cal. 30 MG Pl) Dets of Sig. Serv. Med. Sta. Hosp, ORD, Fin, Q M , Airways. Total 16 off 317 E M.

c. Sig. Det (1 off, 14 E M) now in Jamaica operating Army Radio Station at Spanish Town, in the Administrative Radio Net.

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5. Plan of operation.
By the Commander JBC after consultation with British, local authorities and United States Navy. Incaccordance with J.B. No 308 (Serial 725) August 30, 1941.

SECTION III - Defense Installations

a. Air Defense

Mission - To prevent hostile aircraft from arriving within effective bombing range of United States military and naval installations in Jamaica. Air Defense is under the direction of the Commanding General, Caribbean Air Force.

(1) Air Units. None assigned to permanent garrison, only an Airways Det. (4 off SOEM) for servicing. Units from Carribbean Air Force will operate from the field from time to time.

(2) AA Artillery
To be planned by Commander JBC

(3) AWS - plans
4 long range detectors, S C R 271.
Information Center at Fort Simonds.
(Location of AWS units and Information Center to be approved by Secretary of War.

(4) General

(a) A.C. Installation - Vernam Field being constructed with technical facilities for 1 Gp Bomb (H) with 1 Reconn. Sq. (H) attached. Tropical type buildings (temporary) to be built for A.C.units of 200 officers and 2000 E.M.

(b) Naval Air Units - Facilities for operation of Naval Patrol planes being constructed on Goat Island in Portland Bight.

(c) Civil Defense - Responsibility of local government. (JB No 300 (Serial 725) August 30, 1941

(d) Camouflage - full use.

(e) Protection - Vital elements of defense to be protected by revetments.

b. Beach Defense -
To be indicated by Commander J.B.C.

c. Chemical Defense
To be prepared by Commander J.B.C.

d. Mobile Force Defense
Scheme to be prepared by Commander J.B.C.
Mobile Force Peace Garrison:
Co A 89th Inf; Bty C.A. 3 Mm A A (less 2 plts)
10 off and 311 E.M.

e. Harbor Defense
Plan to be prepared by Commander J.B.C. for 6" Bty at Healthshire Hills- 1- 155 mm Btry in Portland Bight area.

7. Troops
See table.

8. Transportation
32 Vehicles.
6 AC Boats
6 QM Boats

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9. Construction -
Permanent housing only for 22 officers - 15nurses - 463 EM
Temporary type for Bal 375 Peace Garrison
200 officers - 2000 EM for itinerant Bomb Gp.

SECTION IV

12. Program for accomplishing project
see tables

SECTION V

Navy Defense Plan

1. United States Navy - one seaplane ramp on Goat Island in Portland Bight.
2. Material for construction for 2 Squadrons of Tender based Patrol Seaplanes to be stored at Guantanamo.
3. 50 United States Marines are stationed on Goat Island.
4. Further development to be indicated by Commander J.B.C.

SECTION VI

1. General
Small British defense force for defense of Kingston.
Small naval force to man an examination ship.

2. Army
British, Canadian, and Jamaican
Total military : 84 Officers, 1337 men.

Only defenses installed by British are for protection of Kingston Harbor.

SECTION VIII

Local Joint United States - British Defense Plan
To be prepared in accordance with directive being issued by War Department (J.B. No 308 Serial 725, Aug. 30, 1941)

SECTION VIII

Assignment of Troops in an emergency to Carribbean Area in accordance with Rainbow No 4 to be staged at Jamaica.
(see list)

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Jt. American-British Occupation
of French N. Africia

145.81-8
1 Jan 1942
TO BE RETAINED IN THE ARMY
OF THE AAF
PERMANENT FILE

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Secret

Col. George took the original to Gen. Arnold 7/1/42

1 copy to Maj. Hamell

1 " " Mr. McPherson.

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Written Jan. 1, 1942

MEMORANDUM For General Arnold.

Subject: Joint American-British Occupation of French North Africa.

I. Strategic Aspects.

1. Careful examination indicates the Joint American-British occupation by invitation of French North Africa to have the following advantages:

a. Facilitates American-British control of the western Mediterranean and may open to restricted use, the short shipping route to the Near East.

b. Forestalls German action in this area.

c. Provides air bases for immediate bomber operations against Italy; future bomber operations against Germany, and concurrently a base for future land operations against the Axis Powers.

d. Stops flow of raw materials to Germany from and through this area.

e. Covers the Dakar area, preventing or making most difficult reinforcements by sea and air of that area. Hence, the occupation of French North Africa accomplishes to a large extent the advantages to be gained in the occupation of West Africa.

f. Successful occupation of French North Africa should have an advantageous morale effect, particularly in those countries now subjugated by Germany.

2. It is clear that if a successful occupation upon invitation is accomplished, all of the advantages listed above will accrue thereto. However, it is essential to consider what disadvantages would result from an unsuccessful attempt to occupy or to hold North Africa.

3. The disadvantages are discussed in comparison with the advantages listed in the first paragraph.

a. Control of Western Mediterranean and opening to restricted use the short shipping route to the Near East. Failure of the project resulting in stiffening both the Spanish and Vichy French opposition to the Allies, combined perhaps with the occupation

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of key points in Tunisia, Algeria and Morocco by German forces, would doubtless result in complete closing of the very limited route now open to Malta. (It is understood that the British have moved supplies by sea in limited quantities through the Western Mediterranean.

b. Forestalling German action in this area.

So long as Vichy-France maintains a favorable attitude towards Germany, it is possible that the German will not take any major action to secure this area with German Forces, particularly in view of German commitments elsewhere. Germany will probably depend upon the French to hold this area. Failure of an attempt to occupy and hold North Africa would doubtless bring in German forces. Therefore, any possible future A-B operations to secure this area, when the situation might be favorable, would be far more difficult. In substance, while a successful occupation would forestall German action in this area, an unsuccessful operation would commit the Germans to positive action in this area. It would then be difficult to dislodge them.

c. Providing bases for immediate operations against Italy and for future operations against Germany.

Successful occupation would provide these advantages through securing and improving air bases and related facilities. Failure would result in turning over to the Germans, air bases from which they could operate against the British to the east and against any American forces which might move into West Africa.

d. Stopping flow of raw materials to Germany from and through this area.

An unsuccessful occupation would result in more positive German control over this area. Therefore, the Germans might exploit the sources of what raw materials which may be shipped from this area, and thus increase what advantage they now have in this respect.

e. Covering the Dakar area.

Defeat of the A-B forces would be most likely to prove most disastrous to alternative operations involving the seizure of Dakar, the Cape Verde Islands, and the contiguous areas. Forces now available are insufficient to permit simultaneous operations against both French North and West Africa. Coincident with or immediately following German success against American-British forces in North Africa would certainly be the reinforcement of Dakar or occupation by German forces. American-British forces could not hope to withdraw from French North Africa and move into Dakar, to forestall hostile action, nor would available shipping and forces in the United States permit an offensive to be launched against Dakar immediately following the failure of an American-British occupation of French North Africa. It is clear that the Nazis could speedily reinforce Dakar. To forestall American action in

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French West Africa, it would not be unlikely that the Nazis would move the equivalent of one or two heavy bombardment groups to the Dakar area. Such a course, together with the French aircraft already in that area, would make the operation against the Cape Verdes or Dakar extremely hazardous. Furthermore, such aircraft could easily operate against our bases in Freetown and in Monrovia. It is the considered opinion that failure of the North African expedition would result concurrently in securing West Africa. This might be disastrous to British strategy in the Middle East. Air lines of communication through Middle Africa would be cut. Sea lines of communication would be seriously interdicted by Nazi or French submarines operating from Dakar. This result must be viewed in all of its grave significance.

f. Advantageous morale effect in all countries. A successful occupation of French North Africa would have a marked morale effect in all nations, particularly those now subject to German rule. The diametrically opposed result could well attend failure. First, the subject countries might view with grave alarm the weakness of American arms when opposed by the Nazis. Second, it might indicate that the United States is so ill prepared that it cannot at this time or for sometime in the future send any effective forces against Germany. This might do much to strengthen the French-German link, Spain, (doubtless desiring to be on the winning side) might be impressed with the fact that the United States will not be a major opponent for several years and in the interim the Nazis might gain complete domination in Europe. Those countries which will have viewed with acclaim, initiation of American-British operations in French North Africa could only gain a feeling of hopelessness, in that American arms should fail in its initial offensive action. The result might be to restrict further continued undercover opposition to the Nazis in the conquered countries.

4. An invitation by the French to occupy French North Africa must be examined in a critical light. Plans for the occupation should not dismiss the high probability that the German will be informed of this invitation. Certainly, around conference tables of the French where the invitation is discussed, there is certain to be opposition. Those representing the opposition are probably of Nazi leanings. If this is true, the occupation will not be a surprise to the Germans and if they view with importance the seizure of this area by A-B Powers, they will take action to block it. This is particularly true because it appears or would appear to great advantage to the Germans to defeat the Americans in their first offensive against Axis Powers.

5. In view of the disadvantages accruing to an unsuccessful occupation of French North Africa with the defeat of joint American-British forces, it follows that the operation must

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be conducted with that force in that manner that will afford a reasonable chance of success. In the event that the Germans are aware of the invitation and take action to meet it, and in the further event that the forces committed to this action are below that minimum deemed essential for a successful operation, we will have another example of having arrived too late with too little. The operation must be viewed as involving only a calculated risk and not a desperate gamble; the forces involved and their employement must be predicated upon such a premise.

6. The following estimate of the situation discusses in detail the operation and the forces believed essential for its accomplishment.

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Creation of Eastern
Theater Operations /21/

145.81-9
20 Dec 1971
TO THE ARCHIVES OF THE AAF HISTORICAL OFFICE

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DIR 5200.9, 27 Sep 58

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I M M E D I A T E A C T I O N

WAR DEPARTMENT
The Adjutant General's Office
Washington

S E C R E T

AG 371 (12-19-41) MSC-E-M

December 20, 1941.

SUBJECT: Creation of Eastern Theater of Operations.

S E C R E T
Auth: T.A.G.
Initials DRV
Date: 12-20-41

DECLASSIFIED
DOD DIR 5200.9, 27 SEP 80

TO: The Chief of Staff, GHQ;
The Chief of the Army Air Forces;
The Commanding Generals,
Northeast, Central, and Southern
Defense Commands; First, Second,
Third, Fourth and Fifth Corps Areas.

1. The eastern Theater of Operations is hereby created, effective 12 noon, EST, December 24, 1941.

2. Extent: The Eastern Theater of Operations will include the United States bases in Newfoundland and that portion of the continental United States east of a rear boundary as follows:

The line: Ohio-Pennsylvania boundary; Ohio-West Virginia boundary; Kentucky-West Virginia boundary; Kentucky-Virginia boundary; thence L and N Railroad to Knoxville; thence along Southern Railroad via Chattanooga to Birmingham; thence via Selma (Alabama) to the northwest corner of Florida; thence south along the Alabama-Florida Boundary to the Gulf Coast(all to Eastern Theater of Operations).

3. Troops: Detailed assignment of troops is now being prepared. Initially the troops will consist of the First Army, 1st and 3d Air Forces, units of the First, Second and Third Corps Areas including attached units, forces of the Newfoundland Base Command, and all other units now stationed in the Eastern Theater of Operations. Such units of the forces indicated above as are now located outside of the boundaries of the Eastern Theater are at the disposal of the Commanding General thereof, but will not be given permanent change of station without authority of the War Department.

4. Transfer of Responsibilities:

a. The Commanding General, Central Defense Command, will take over the responsibilities of the former Northeast Defense Command in the area west of the rear boundary of the Eastern Theater and north of the present boundary between the Northeast Defense Command and the Southern Defense Command.

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b. The commanding General, Eastern Theater will take over the responsibilities of the Southern Defense Command in the area east of the rear boundary of the Theater.

c. Transfer of responsibilities will be arranged directly between the Commanding Generals concerned.

5. Special Provisions:

a. Units of the Newfoundland Base Command shall not be transferred to other areas without authority of GHQ.

b. Disruption of existing Coastal Frontier organizations should be held to a minimum.

c. In this critical emergency, measures now being taken to create new air units will necessitate frequent and embarrassing transfers of personnel and materiel. It is desired that commanders concerned facilitate and expedite such transfers.

d. In order that the War Department may not be embarrassed in the air reinforcement of overseas garrisons, the heavy and medium bombardment groups in the Eastern Theater of operations will not be given permanent changes of stations without authority of the War Department.

e. The intergrity of the present interceptor command setup, including its communication system, will be preserved.

f. For airdrome defense, ground troops should be used. Air troops will not be employed for this purpose except in cases of sudden emergencies.

g. Air force units must be afforded every possible opportunity for combat training, including ammunition, consistent with other requirements. Ground units of the Eastern Theater of Operations also must be given every opportunity to continue their training under the Theater Commander.

h. Insofar as possible, air force organizations should be kept intact, prepared for prompt movement to other theaters.

i. Transit airplanes destined for other theaters and for delivery from factories will be under the direction of the Chief of the Army Air Forces. The Theater Commander will be informed of such movements through Air Force Commanders. The urgency for immediate action in connection with the movement of such planes necessitates certain operational instructions being issued directly by the Chief of the Army Air Forces to the Air Force Commander.

j. The Commanding General, Eastern Theater of Operations, will have command of Corps Area activities and units within the boundaries of the Eastern Theater. This control will be exercised

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with as little disturbance as possible to existing procedure. Administrative functions of the Corps Areas will continue to be exercised directly under the War Department. General depots, air depots, schools, training units and facilities of the Air Corps and other establishments under War Department control will not be disturbed in their functions except as necessary to meet sudden critical emergencies.

k. The Commanding General, Eastern Theater of Operations, will be responsible for defense against internal as well as external threats to the territory and installations within the Theater.

l. GHQ should be kept advised of contemplated or suddenly ordered movements of major troop units.

6. Administrations. The War Department appreciates that the establishments of this theater will require many complicated adjustments in administration and organization. It is desired that all commanders and staffs endeavor to make these adjustments as smoothly as possible.

7. Command: Lieut. General Hugh A. Drum is designated as Commander of the Eastern Theater of Operations. GHQ is the agency through which the Chief of Staff, in his capacity as Commander of the Field Forces, will exercise command over the Theater.

8. It is desired that the Commanding Generals, First, Second, Third Fourth, and Fifth Corps Areas inform the Commanding Officers of all posts, camps, and stations within the limits of their respective Commands, of the above.

By order of the Secretary of War:

Major General,
The Adjutant General.

COPIES FURNISHED:
The Chief of Naval Operations;
The Divisions of the War Department
General Staff.

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Air Defense /22/
Eastern Theatre

FILE NO.
145.81-10
JAN 1942
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TO THE ARCHIVES
OF THE AAF
HISTORICAL OFFICE

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HAC

WAR DEPARTMENT
Headquarters Army Air Forces
Office, Chief of the Air Staf.
Air War Plans Division

Date FEB 4 1942

TO:

All Officers _____
Lt. Col. George _____
Lt. Col. Walker (2)
Maj. Fair _____
Maj. Taylor _____
Capt. Alling _____

Maj. Hansell _____
Maj. Lindsay _____

Lt. Col. Craig (1) 1146
Lt. Col. Partridge (2) EGP
Maj. Wolfinbarger _____
Maj. Gillespie _____
Capt. Oscanyan _____

Lt. Col. Anderson _____
Maj. Anderson _____

Maj. Glantzberg _____

Capt. Harper _____
Mr. McPherson _____

file.
Dist in Section.

____ Information
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OFFICE OF THE CHIEF OF NAVAL OPERATIONS

26 January 1942

Memorandum for General Arnold:

The attached report from Brig. Gen. Krogstad is returned with thanks.

F.J.Horne

1/28/42

To A-3
A.W.P.
A.W. note
file

1/28/42

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IN REPLY
REFER TO:

HEADQUARTERS
AIR FORCES, EASTERN THEATRE OF OPERATIONS
and
FIRST AIR FORCE
OFFICE OF THE AIR FORCE COMMANDER
MITCHEL FIELD, NEW YORK

January 25, 1942.

MEMORANDUM TO: Lieutenant General H. H. Arnold, U. S. Army, Chief of Army Air Forces and Deputy Chief of Staff, U. S. Army.

The following report is made pursuant to our telephonic conversation of January 25, 1942:

Situation as it effects the South Atlantic Naval Coastal Frontier Defense, Headquarters, 6th Naval District at Charleston, S. C.

The War Department directive of December 30, 1941 gave the Eastern Theatre of Operations one observation group (66th) located at Miami and Jacksonville, and the following bases all maintained by Third Air Force DP detachments:

Jacksonville, Florida
Columbia, South Carolina
Pope Field, Ft. Bragg, North Carolina

All located south of Norfolk in the old Third Air Force area.

We secured from AFCC permission to use:

Key West Airport
Miami Airport
Charleston Airport

On January 12th, with representatives of First Bomber Command, First Interceptor Command, and First Air Support Command, I held a conference with Captain Crenshaw, U. S. Navy, at Key West. After a complete discussion he recommended that:

1 Observation Squadron be located at Key West
1 " " " " " Miami
1 " " " " " Charleston

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On January 14th, we visited Admiral Allen at Charleston, S. C. After a complete discussion, Admiral Allen recommended as follows:

A striking force at Miami - 3 B-18's
2 Observation Squadrons at Miami
1 Observation Squadron, with Group Headquarters at Charleston
A liaison officer with authority to act, at his headquarters.

Some mention was made to the effect that the Naval Headquarters would order the Army Air Force planes on missions and I definitely and purposely made it clear that the experienced Air Corps liaison officer we would give them would issue all orders and be responsible for all of our operations. Colonel Kimberly, CAC, was there as liaison officer for the Sector Commander at Atlanta and it was made clear that he would have no authority over our operations although he was the senior liaison officer present. Cooperation with the Navy was stressed. See copy of written instructions to Colonel Louis M. Merrick, AC, our liaison officer. I had previously given him verbal instructions. I submitted a plan of operations to the Commanding General, Eastern Theatre of Operations upon my return, which he approved. See copy attached.

We have arranged our communications and moved our units and the system is operating.

Subsequently, because of the submarine threat at Hatteras, we diverted 2 B-18's from Miami to Charleston and informed Colonel Merrick that they could also be used as convoy escorts when the Navy desired such escorts.

We also requested and obtained from the 3rd Air Support Command at Savannah, Georgia, 4 A-20's to be held on the alert as a striking force subject to Colonel Merricks instructions. They have already been used. When the 8th Air Force moves, these A-20's will no longer be available but we will ask the Third Air Force to make something else available.

Army, Navy cooperation has been fine as soon as we could crystalize on operational procedures. Colonel Merrick has a direct wire to the Joint Operations Headquarters, 90 Church Street, New York, and can arrange for immediate help from Langley Field, if available there.

Arnold N. Krogstad

ARNOLD N. KROGSTAD,
Brigadier General, Air Corps,
Commanding.

8 Incls.
#1 - Ltr 373, 1/23/42
#2 - Ltr 1/16/42
#3 - Ltr 334.8 1/17/42
#4 - Ltr 334.3 1/17/42
#5 - Ltr 201 1/24/42
#6 - Rpt 1/21/42
#7 - Rpt 1/24/42
#8 - Recap. 1/25/42
#9 - Combat Crew Status Report 1/25/42

1/28/42

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HEADQUARTERS
AIR FORCES, EASTERN THEATRE OF OPERATIONS
and
FIRST AIR FORCE
OFFICE OF THE AIR FORCE COMMANDER
MITCHEL FIELD, NEW YORK

January 23, 1942

SUBJECT: Southern Frontier Striking Force.

TO : Commanding General, First Bomber Command, 90 Church Street, New York, New York.

1. The Air Force Combat Command has informed this headquarters that all A-20 aircraft and crews at Savannah Air Base are being made available to this headquarters for use on call to augment the striking force of your command in the southeast. It is desired that you notify Colonel Merrick of the above and inform him to call upon the Third Air Support Command, Savannah, for such missions as may become necessary.

2. It is further desired that you notify this headquarters as to the strength of this augmentation in aircraft and crews as soon as determined by you.

By command of Brigadier General KROGSTAD:

H. B. SEPULVEDA,
Lt. Col., A.G.D.,
Adjutant General.

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Joint Operations Office
90 Church Street
New York, New York

January 16, 1942

MEMORANDUM

Conference 1500 EST 16 January 1942 between Lieutenant General Drum, Rear Admiral Andrews and Brigadier General Krogstad.

In order to:

(a) More thoroughly search the submarine area and shipping lanes.

(b) Conserve personnel and equipment.

It was agreed to reduce the distance at present being flown by the patrols of the First Bomber Command to approximately 200 miles from the shoreline to seaward.

Brigadier General Krogstad advised for the present patrols from Bangor, Maine would be discontinued and the patrols would be run from Westover Field, Massachusetts, Mitchel Field, Long Island and Langley Field, Virginia. Details of the patrols to be worked out by Operations Officer of the Bomber Command in consultation with Air Officer NANCF.

Later the following patrols were agreed upon:

1. Planes from Westover Field search the sector 73° true to 140° true from Cape Cod extending 200 miles to seaward.

2. Mitchel Field planes to search the area between line extending 140° true from Cape Cod and the line extending 125° true from Atlantic City extending 150 miles from shoreline to seaward.

337 Conferences
X 373 Joint Operations (See original file)
X 365.1 Naval Operations

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3. Langley Field planes to search the area between a line extending 125° true from Atlantic City to a line due east of Cape Hatteras extending 150 miles from the shoreline to seaward.

The above patrols effective immediately.

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HEADQUARTERS
AIR FORCES, EASTERN THEATER OF OPERATIONS
and
FIRST AIR FORCE
Office of the Commanding General
Mitchel Field, New York

334.3

January 17, 1942

MEMORANDUM: Conference at Headquarters Eastern Theater of Operations, January 16, 1942.

Officers Attending:

Lieutenant General Hugh A. Drum,
Brigadier General Arnold N. Krogstad,
Brigadier General Kenneth P. Lord, C/S, ETO,
Colonel William E. Kepner,
Colonel Charles P. Prine.

At this meeting General Drum was informed of the information which we had secured on a recent trip to Key West, Miami, Tampa, Jacksonville, Orlando, Charleston and Langley Field.

A plan was then presented for his consideration involving the use of the 65th Observation Group and a striking force on the South Atlantic coastline. The plan presented was to operate two Observation Squadrons from Miami, utilizing the airdrome at Key West as the advance airdrome. A striking force of 4 B-18s to be maintained by the First Air Force at Miami. The Headquarters Squadron and 1 Observation Squadron to be located at Charleston, South Carolina in the vicinity of the Headquarters Southern Atlantic Coastal Frontier Defense. A liaison officer of the First Bomber Command would be stationed at this Headquarters. This liaison officer to be authorized to act on such information furnished him from the Navy or the Observation Group and the Task Force at Miami to be under his control. In the event of any matters coming up which would be beyond the capacity of the Task Force at Miami, the liaison officer would communicate over a direct line with the First Bomber Command at 90 Church Street, New York City, requesting such additional striking forces as may seem necessary.

Colonel Kepner, in command of the First Air Support Command, was instructed to draw up a directive and to continue supervision and jurisdiction over this Observation Group, but the operational control would remain in the hands of the liaison officer.

/s/ Arnold N. Krogstad
/t/ ARNOLD N. KROGSTAD,
Brigadier General , U. S. Army,
Commanding.

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HEADQUARTERS
AIR FORCES, EASTERN THEATER OF OPERATIONS
and
FIRST AIR FORCE
Office of the Commanding General
Mitchel Field, New York

334.3

January 17, 1942

Memorandum of Agreement

between

The Commanding General, Eastern Theater of Operations

and

The Admiral Commanding the North Atlantic Coastal Frontier Defense

A conference was held in the office of the Commandant, North Atlantic Coastal Frontier Defense on January 16, 1942. The following officers were present:

Lieutenant General Hugh A. Drum, U. S. Army,
Rear Admiral Adolphus Andrews, U. S. Navy,
Brigadier General Arnold N. Krogstad, U. S. Army,
Captain Stapler, U. S. Navy.

The conference was called for the purpose of discussing a revision of existing plans with regard to the airplane patrol of the First Air Force. The present airplane patrols by bombardment airplanes have been proceeding to a point 450 miles offshore. The observation planes have been patrolling to a distance 40 miles at sea. It is obvious that a number of hostile submarines are now operating in close proximity to our coastline. As the bombardment planes were the only planes which carried bombs or ammunition, it was believed that every effort should be made to have a striking force available to cover the areas in which hostile submarines were known to be operating.

The fact was also brought out that the intensive patrolling by a limited number of pilots and airplanes made it necessary to seriously consider the element of conservation of both personnel and aircraft. Most of the reports on submarines' activity have been coming from observation planes operating within 60 miles of the coast. It was the consensus of opinion of those present that limiting the offshore patrol to a radius of approximately 200 miles at sea would serve to increase the possibility of having striking forces available and would assist in conserving personnel and aircraft.

The agreement was therefore reached to limit the offshore patrols

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Letter of Agreement, [illegible] Joint Plan CCD.

to approximately 200 miles off shore and to make every effort to obtain [illegible] from the Naval authorities at appropriate times clearance for the operation of a surface force against a submarine within such area as could be determined by the Navy.

J. T. C. STARKER
Captain, USN (Ret.)
Chief of Staff
North Atlantic Naval
Coastal Frontier

ARNOLD N. KROGSTAD,
Brigadier General, U. S. Army,
Commanding.

APPROVED: January 18, 1942.

H. A. DRUM,
Lieut. General, U. S. ARMY,
Commanding.

COPIES FURNISHED:
General Staff, First Air Force,
CG, First Bomber Command, MAC,
CG, First Air Support Command, Mitchel Field, N. Y.,
CG, First Interceptor Command, MAC.

REPRODUCED FIRST AIR FORCE 1/20/42

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IN REPLY REFER TO:

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HEADQUARTERS
AIR FORCES, EASTERN THEATRE OF OPERATIONS
and
FIRST AIR FORCE
OFFICE OF THE AIR FORCE COMMANDER
MITCHEL FIELD, NEW YORK

January 24, 1942

SUBJECT: Duties as Liasion Officer.

TO : Lieutenant Colonel Louis M. Merrick, AC, U.S. Army
Liasion Officer, Air Forces, E.T.O. and First
Air Force and First Bomber Command
Headquarters Sixth Naval District
Navy Yard
Charleston, South Carolina.

1. Orders are being issued for your permanent change of station to Charleston, South Carolina, for the purpose of your acting as Liasion Officer of the Air Forces, E.T.O. and First Air Force and of the First Bomber Command. The assignment of a Liasion Officer of this command to the headquarters of the South Atlantic Naval Coastal Frontier Defense Command was approved by the Commandant, Admiral Allen, on January 22, 1942. This assignment was subsequently approved by General Drum Commanding General Eastern Theatre of Operations.

2. The purpose of this assignment was to enable the Commanding General Eastern Theatre of Operations to be represented in air matters at this important naval command. It is desired that you make every effort to cooperate with the United States Navy in all matters.

3. Initially, the following troops have been placed under your operational control: The 66th Observation Group and four B-18s with the necessary crews. In view of the fact that the 66th Observation Group is a part of the First Air Support Command, the Commanding Officer of the First Air Support Command will continue to exercise the necessary supervision over its training and administration. The existing DFs in the Third Air Force will be maintained by the Third Air Force for the present.

4. The First Air Support Command has issued certain operating instructions pertaining to the technique of operations of the 66th Observation Group. You are authorized to conduct the patrols from the 66th Observation Group in such manner as will, in your opinion, best fulfill the desires of the Navy. You are also authorized to change the base of the four B-18s in the striking force when such change will be conducive to their more efficient operation. It is desired that whenever any changes from the existing procedures are made by you that you inform these headquarters of such changes through the First Bomber Command, 90 Church Street, New York, New York.

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Duties as Liasion Officer.

5. An outline of the communications made available to you will be furnished you later.

6. Whenever any travel is necessary in the conduct of your operations, it is desired that you request the First Bomber Command to issue the necessary orders. Pursuant to our previous conversations, an official car, an airplane and certain personnel have been made available to you. Any additional personnel you find necessary to conduct your operations on a twenty-four hour basis should be secured first from any personnel available in the 66th Observation Group.

7. You will not be concerned with the administration of either the 66th Observation Group or the striking force.

8. You will take the necessary steps to acquaint yourself with the location of such facilities including bombs, ammunition, depth charges that may be required by the striking force.

9. It is desired that you keep this office, through the First Bomber Command, advised as to your difficulties in order that rapid progress can be made in getting your work established on an efficient basis.

ARNOLD N. KROGSTAD,
Brigadier General, U. S. Army
Commanding.

Copies to:

CG, E.T.O., Governors Island, NY
CG, 1st Bomber Command, 90 Church Street, New York, N. Y.
Commandant, North Atlantic Naval Coastal Frontier Defense Command, 90 Church St., New York, N. Y.
Commandant, Sixth Naval District, Navy Yard, Charleston, South Carolina
CO, First Air Support Command, Mitchel Field, N.Y.

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Hq & Hq Bomb Squadron (H)

DAILY AIRCRAFT STATUS REPORT (SUBMITTED PRIOR TO 730 EACH FLYING DAY) LANGLEY FIELD, VIRGINIA

TO: Commanding Officer, 2nd Bomb Group (H) ___
Material Officer, 2nd Bomb Group (H) ___

January 21, 1942.
Wednesday

NOTE: ALL TIMES TO NEAREST HOUR

SQ. NO.	A.C.A.C.	CREW CHIEF	TYPE	STATUS IN OUT (SPELL)	CAUSE OF BEING OUT OF COMMISSION AND ACTION TAKEN	ACFT TIME	ENGINE TIME 1	2	3	4	PILOT TIME	TIME SINCE 50HR	Date airpl. will be in comm. T.C. Compl per 2nd Ip Cirls. 20-3, 2-14-41. Dates of arrival and Departure of airpl. New Engine Numbers.
#31	39-3		B-17B	DS		1160	95	95	59	95	466	5	
	36-153	Jernejec	B-17	IN	complete	1472	207	207	207	207		36	
	36-161	Aulsbury	B-17	OUT	No record of time available. No brakes.	55	55	55	55	55		8	Indefinitely. Awaiting brakes.
	36-159	Flanders	B-17	OUT	50 hr. inspection to be made.	1098	521	521	390	390		51 XXX	
	36-155	Canada	B-17	IN		863	291	472	12	165		18	
	36-149	McKenna	B-17		Airplane is down at Rehoboth Beach.	73	73	73	73	73	73	21	Date of return to this station is not known.
#5	40-1197	Longshore	BT-14	IN		1264	411				893	38	
#4	40-1198	Longshore	BT-14	IN		1253	12				174	12	
#10	40-2166		B-25	OUT	Spare parts plane.	114	105	114			114		
#7	35-99	Longshore	A-17	OUT	Hydraulic cylinder out.	161	161				161	6	
	39-3			IN	LINK TRAINER	-							

* Whenever engines are changed, new engine numbers will be listed in this column.

ENGINEERING OFFICER CLINTON W. UER, 1st Lt., A.C.

47° not in stock on 1 of B
43 In @ 1 # 6

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NINETY SIXTH Bomb Squadron (H)

DAILY [illegible] (SUBMITTED [illegible] TO 730 [illegible] FLYING DAY) LANGLEY FIELD, VIRGINIA,

TO: Commanding Officer, 2nd Bomb Group (H)
Material Officer, 2nd Bomb Group (H)

JANUARY 21, 1942.

SQ. NO.	A.C.NO.	CREW CHIEF	TYPE	ENGINE IN (OUT)	CAUSE OF ENGINE OUT OF COMMISSION AND REMARKS	ENGINE TIME					AIRCRAFT TIME (Cum. next time)	ENGINE CHANGE HOUR	Date A/C will be in com. T.C. Comd. per 2nd Ftr. Circular 20-d, 2-1c-41. Dates of Arrival & Departure of A/C. Flown to, by*
						#1	#2	#3	#4				
72	37-470	SGT. SHELTON	B-18A	OUT	LOOMR. INSP. &STARTER N.I.S	2493:00	134:0	141:0			134:00	59:0 60	
74	37-593	S/SGT. BABER	B-18A	IN		2065:0	99:00	99:00			99:00	40:00	
76	37-613	CPL.MICCAHIONE	B-18A	IN		1990:0	96:00	96:00			96:00	47:00	
78	38:598		B-18A	OUT	CRASHED 1-7-42								CRASHED 1-7-42
	41-2393	T/SGT.KLINE	B-17E	OUT	CRASHED NEWFOUNDLAND	125:	125:00	125:00	125:0	125:0	125:0	28:00	CRASHED NEWFOUNDLAND
	41-2473	S/SGT BAIRD	B-17E	IN		47:00	47:00	47:00	47:00	47:00	47:00	47:00	
	41-2410	S/SGT.GARVER	B-17E	OUT	LANDING GEAR Clutch	96:00	96:00	96:00	96:00	96:00	96:00	5:00	LANDING GEAR CLUTCH
	36-154	S/SGT RIEKOWSKI	B-17	OUT	BRAKES N.I.S.	120:00	120:00	120:00	120:0	120:0	120:00	00	BRAKES N.I.S
	36-160	S/SGT. MOORE	B-17	OUT	BRAKES FUSED	26:00	26:00	26:00	26:00	26:00	26:00	7:10	BRAKES FUSED
	40-1199	SGT. PERKINS	B-14	OUT	TAIL WHEEL STRUT N.IS.	1231:00	150:0				150:00	33:00	TAIL WHEEL STRUT N.I.S.
	40-1212	PVT. CALLOWAY	BT-14	IN		854:00	229:00				854:0	17:00	
	41-2500	S/SGT HEVENER	B-17E	OUT	FUEL PUMP N.I.S	23:00	23:00	23:00	23:00	23:0	23:00	23:00	FUEL PUMP N.I.S
	41-2405		B-17E	IN		154	154	154	154	154	154	46:30	

* Whenever engines are changed, new engine numbers will be listed in this column.

ARTHUR J. STAVELEY, 1st LIEUT. A.C.

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NOTE: 1 B-17E transferred to Drew Field, Fla.
1 LB-30 transferred to Albuquerque.
* 11 DB-7B recd from Base.
6 LB-30 transferred out of 1st Air Force (43rd Bomb Gp).

AIRCRAFT STATUS REPORT

FIRST BOMCOM

January 24, 1942

UNIT	STATION	TYPE	NUMBER EACH TYPE ASSIGNED	FLY, FIRE, BOMB	FLY, FIRE	FLY	OUT COLLISION	COMBAT CREWS AVAILABLE	TOTAL
HQ SQ 1ST BOMCOM	MITCHEL	B-18A	2	0	0	2	0	0	
	TOTAL		2	0	0	2	0	0	
2ND BOMB GROUP	LANGLEY	B-17	7	2	0	0	5	0	
		B-17E	3	2	0	0	1	0	
		B-18A	3	3	0	0	0	0	
		B-25	1	0	0	0	1	0	
		B-25A	10	9	0	0	1	2	
		B-25B	1	1	0	0	0	0	
DET 2ND BOMB GROUP	CHARLESTON MIAMI	B-18	4	3	0	0	1	~~2~~ 4	
	TOTAL		29	20	0	0	9	~~6~~	
13TH BOMB GROUP	WESTOVER	B-25	1	0	0	0	1	0	
		B-25A	2	2	0	0	0	0	
		B-25B	19	14*	0	0	5	0	
	TOTAL		22	16	0	0	6	0	
3RD RECON SQ	MITCHEL	B-25	2	0	0	0	2	0	
		B-25B	7	6*	0	0	1	0	
	TOTAL		9	0	0	6	3	0	
45TH BOMB GROUP	MANCHESTER	B-18	1	1	0	0	0	0	
		B-18M	3	1	0	0	2	0	
		*DB-7B	57	0	18	16	23	0	
		A-20A	2	1	0	0	1	0	
	TOTAL		63	3	18	16	26	0	
	TOTAL BOMB		125	39	18	24	44	6 ~~10~~	

* These airplanes can fly and bomb only.

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TWX-ON DIRECT LINE

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TO: COMAOC BOLLING FIELD DC

LAF _____ F PERIOD GIIF ACC 449E PERIOD

SQUADRONS	LOCATION	TYPE	IN COMMISSION	OUT COMMISSION
52ND PURSUIT GROUP				
HQ & HQ SQ				
2ND PURSUIT SQ				
4TH PURSUIT SQ				
5TH PURSUIT SQ				

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NOTE: 1 P-40 Sub depot, Bolling Field for repairs.
1 P-40 turned over to depot for repairs.
1 P-40 of 66th Pur Sq reported in error 23rd shoulb be 3 instead of 4.
8 P-39D, 1 P-40 and 2 P-40G transferred out of 1st AF (52nd Pursuit Group).

AIRCRAFT STATUS REPORT

FIRST INTERCOM

January 24, 1942

UNIT	STATION	TYPE	NUMBER EACH TYPE ASSIGNED	FLY, FIRE, SUB	FLY, FIRE	FLY	OUT CONDITION	COMBAT CRFS AVAILABLE	TOTAL
33RD PURSUIT GP	PHILADELPHIA	A-20A	1	0	0	1	0	0	
		P-40	13	0	9	0	4	5	
		P-40C	8	6	1	0	1	7	
		P-40E	1	0	0	0	1	0	
		P-40E-1	3	0	2	0	1	5	
	TOTAL		26	6	12	1	7	17	
56TH PURSUIT GP	BENDIX	P-35A	2	0	0	0	2	3	
		YP-39	2	0	0	1	1	2	
		P-36A	9	0	9	0	0	5	
		P-36C	11	0	6	0	5	0	
		P-39C	1	0	0	0	1	0	
		P-39D	7	6	0	0	1	0	
	TOTAL		32	6	15	1	10	10	
57TH PURSUIT GP	BOSTON	-----	0	0	0	0	0	0	
		A-20A	1	1	0	0	0	0	
		P-39D	10	0	7	0	3	7	
		P-40	4	0	2	0	2	0	
		P-40A	1	0	1	0	0	0	
		P-40C	2	0	0	1	1	0	
		P-40E	4	0	1	1	2	2	
		P-40G	1	0	1	0	0	0	
		P-40E-1	7	0	6	0	1	1	
	TOTAL		30	1	18	2	9	10	
	TOTAL PURSUIT		88	13	45	4	26	37	

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TWX-ON DIRECT LINE

_____ 194 _

TO: COMACC BOLLING FIELD DC

INF _____F PERIOD CITF ACC 449F PERIOD

SQUADRONS	LOCATION	TYPE	IN COMMISSION	OUT COMMISSION
52ND PURSUIT GROUP				
HQ & HQ SQ				
2ND PURSUIT SQ				
4TH PURSUIT SQ				
5TH PURSUIT SQ				

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FIRST AIR FORCE

January 25, 1942.

Pilot Strength

Unit		Auth	Asgd	(Over) or Short	Remarks
Hq & Hq Sq 1st ASC		13	7	6	
26th Obsn Gp		64	48	16	Auth = 10 + (3 x 18) = 64
59th Obsn Gp		64	42	22	
65th Obsn Gp		64	37	27	
66th Obsn Gp		64	57	7	
	Total	269	191	78	Obsn Pilots
Hq & Hq Sq 1st BC		13	9	4	
2nd Bomb Gp (H)		64	46	18	
13th Bomb Gp (M)		93	67	26	Including 30 D/S w/Perry Comd
3rd Recon Sq (M)		26	26		
45th Bomb Gp (M)		119	51	68	Incl Recon Sq not yet detchd
	Total	315	199	116	
Hq & Hq Sq 1st IC		20	9	11	
33rd Pur Gp (I)		114	80	34	
56th Pur Gp (I)		114	74	40	
57th Pur Gp (I)		114	79	35	
	Total	362	242	120	
Hq & Hq Sq 1st AFBC		11	3	8	
Langley 1st AB Gp		5	9	(4)	
" 2nd AB Sq		2	2		
Mitchel 2nd AB Gp		5	5		
" 1st AB Sq		2	4	(2)	
" 31st AB Gp		5	5		
Bangor 8th AB Gp					Under orders
" 7th AB Sq		2	1	1	
Westover 26th AB Gp		5	6	(1)	
" 25th AB Sq		2		2	
Windsor 30th AB Gp		5	2	3	
" 29th AB Sq		2		2	
Manchester 33rd AB Gp		5	3	2	
" 34th AB Sq		2		2	
		41 12	33 7	8 5	

Recapitulation

Hq & Hq Sq 1st Air Force	31	12	19
1st Air Support Command	269	191	78
1st Bomber Command	315	199	116
1st Interceptor Command	362	242	120
1st Air Force Base Command	53	40	13
Grand Total	1030	674	356

Incl #8

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HEADQUARTERS FIRST AIR FORCE
Mitchel Field, N. Y.

January 25, 1942

UNIT	STATION	Pilots	Co-pilots	Maintenance Crews	Navigators	Bombardiers	Combat Crews Available	TOTAL
FIRST BOMBER COMMAND								
2d Bomb Group (less 49th Sq and Detachment)	Langley							
	2-engine	14	0	10				
	4-engine	8	2	13				
	TOTAL	22	2	23	1	2	1	
Det. 2d Group	Miami							
	2-engine	4	0	4	2	3	2	
TOTAL 2d BOMB GROUP		26	2	27	3	5	3	
13th Bomb Group	Westover Field -							
	2-engine	45	11					
	4-engine	2	0					
	TOTAL	47	11	33	3	27	3	
45th Bomb Group	Manchester							
	2-engine	15	0	16	0	0	0	
	4-engine	3	0	0	0	0	0	
	TOTAL	18	0	16	0	0	0	
3rd Recon Squadron	Mitchel							
	2-engine	12	14	13	0	0	0	
TOTAL BOMBER COMMAND		103	27	89	6	32	6	

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COMBAT CREW STATUS REPORT

(PERSONNEL IMMEDIATELY AVAILABLE)

HEADQUARTERS FIRST AIR FORCE
Mitchel Field, N. Y.

January 25, 1942

UNIT	STATION	Pilots	Co-pilots	Maintenance Crews	Navigators	Bombardiers	Combat Crews available	TOTAL
FIRST BOMBER COMMAND								
2d Bomb Group (less 49th Sq and Detachment)	Langley							
	2-engine	14	0	10				
	4-engine	8	2	13				
	TOTAL	22	2	23	1	2	1	
Det. 2d Group	Miami							
	2-engine	4	0	4	2	3	2	
TOTAL 2d BOMB GROUP		26	2	27	3	5	3	
13th Bomb Group	Westover Field							
	2-engine	45	11					
	4-engine	2	0					
	TOTAL	47	11	33	3	27	3	

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45th Bomb Group	Manchester						
	2-engine	15	0	16	0	0	0
	4-engine	3	0	0	0	0	0
	TOTAL	18	0	16	0	0	0
3rd Recon Squadron	Mitchel						
	2-engine	12	14	13	0	0	0
TOTAL BOMBER COMMAND		103	27	89	6	32	6

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COMBAT CREW STATUS REPORT

ERSONNEL IM EDIATELY AVAILABLE

January 25, 1942

HEADQUARTERS FIRST AIR FORCE
Mitchel Field, N. Y.

UNIT	STATION	Pilots	Co-pilots	Maintenance Crews	Navigators	Bombardiers	Combat Crews Available	TOTAL
FIRST INTERCEPTOR COMMAND								
33d Pursuit Group	Philadelphia	80	0	66	0	0	17	
56th Pursuit Group	Bendix	74	0	30	0	0	10	
57th Pursuit Group	Boston	79	0	49	0	0	10	
TOTAL INTERCEPTOR COMMAND		233	0	145	0	0	37	
TOTAL TRAINED PILOTS		40						
FIRST AIR SUPPORT COMMAND								
26th Obsn Group	Providence	48	0	-	0	0	21	
59th Obsn Group	Camp Dix	35	0	-	0	0	19	

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65th Obsn Group	Langley	37	0	-	0	0	17
66th Obsn Group	Miami	57	0	-	0	0	36
TOTAL AIR SUPPORT COMMAND		177	0	-	0	0	93

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Additional Notes, Colonel Wooten, 1/14/42

hoods for pursuit type airplanes.

Night interception would be most difficult and possible only by operating in cooperation with searchlights due to lack of suitable night type airplanes and AI equipment.

Maintenance is most difficult due to the lack and slowness in the delivery of spare parts. Aircraft has been out of commission for weeks awaiting parts taking but a few minutes to install. It is believed that Air Bases should give priority to airplanes engaged in the continental defense of the United States.

Note: This statement received by telephone from Major Bulger, First Interceptor Command.

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HEADQUARTERS 1ST AIR SUPPORT COMMAND
MITCHEL FIELD, NEW YORK

January 14, 1942.

MEMORANDUM: For Colonel Wooten.

SUBJECT: Present Operations of 1st Air Support Command.

Maps: Chart No. VP 102 herewith.

1. The 1st Air Support Command is operating at present in accordance with Letter of Instructions No. 1, this headquarters, 18 December 1941 and Letter of Instructions No. 2, 31 December 1941, copies attached. The strength of this organization in aircraft, in and out of commission, is as indicated in status report herewith. Location of organizations is as follows:

E

New England Sector

26th Observation Group and 103rd Observation Squadron at Hillsgrove, R. I.
152nd Observation Squadron, Fort Devens, Mass.
101st " " Camp Edwards, Mass.

New York-Philadelphia Sector

59th Observation Group, 126th Observation Squadron, Fort Dix, N. J.
119th Observation Squadron, Newark, N. J.
104th " " Atlantic City, N. J.

Chesapeake Sector

65th Observation Group, 105th Observation Squadron, 121st Observation Squadron, Langley Field, Va.
112th Observation Squadron, Dover, Delaware.

2. Due to scarcity of observation aircraft, it has been impossible to cover the area 40 miles off shore from Eastport, Maine to the southern boundary of the Chesapeake Sector. Priorities have been established as follows:

New England Sector: The approaches to Boston Harbor.
New York-Philadelphia Sector: (1) The approaches to New York Harbor. (2) The Delaware Bay entrance.
Chesapeake Sector: Chesapeake Bay entrance.

Units have been instructed to cover their priority assignment and work outward therefrom to the limit of availability of aircraft; the extent of area

Incl 5 - Tab E

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covered varying with the number of aircraft in commission and with the spacing of flight lines as determined by the visibility from day to day. As it has actually worked out, the New England Sector has been covered from Portland to its southern boundary. The New York-Philadelphia Sector has been covered throughout, and the Chesapeake Sector from its northern boundary to Cape Hatteras, with a patrol of light aircraft operating in the lower reaches of the Chesapeake Bay. Patrols are run at dawn and dusk, with at least one patrol at irregular times during the remainder of the day.

3. Immediate difficulties in properly covering the assigned area beyond the control of this command are as follows:

a. Lack of suitable aircraft. In this connection, a letter has been forwarded, through the Commanding General, First Air Force, requesting requisition of suitable, light, twin-engine, private aircraft. Another project for the loan of at least 27 DB-7 type airplanes to the observation units has been presented to the First Air Force.

b. Shortage of enlisted personnel is such that at present mechanics, who are needed to maintain aircraft, are being used to provide essential guard and for other housekeeping duties. It is considered essential that basic enlisted men be made available to units of this command, immediately, to partially relieve this situation.

4. Sufficient officer personnel exist to cover the areas outlined above with a dawn-to-dusk patrol in an efficient manner, if aircraft and personnel to maintain them can be made available.

5. It is to be noted that the 66th Observation Group is not operating as a part of the 1st Air Support Command.

For the Commanding Officer:

JOHN P. DOYLE, JR.,
Major, Air Corps,
Executive.

2 Incls.
Ltr. of Instr. No. 1
" " " No. 2

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Ltr of Instr No. 1, 1st ASC, 12-18-41.

3. The boundaries of the Coastal Frontier Sectors within the reconnaissance zone, and assignment of group areas, are as follows:

a. New England Sector, 26th Observation Group:

Northern boundary - Eastport, Me. south to Latitude 43° 45' N.
Southern boundary - line from New London, Conn. through Montauk Point prolonged. (Note: This does not coincide exactly with sector boundary)

b. New York - Philadelphia Sector, 59th Observation Group:

Northern boundary - same as southern boundary New England Sector.
Southern boundary - line east from Maryland-Delaware border at Fenwick Island light.

c. Chesapeake Sector, 65th Observation Group:

Northern boundary - same as southern boundary New York-Philadelphia Sector.
Southern boundary - line east from Wilmington, N. C.

4. Attachments and location of units as follows, effective upon issuance of necessary orders:

Hq. & Hq. Sqdn, 26th Observation Group	Providence, R. I.
101st Observation Squadron	Camp Edwards, Mass.
152nd Observation Squadron	Camp Devens, Mass.
103rd Observation Squadron	Providence, R. I.
Hq. & Hq. Sqdn, 59th Observation Group	Fort Dix, N. J.
104th Observation Squadron	Atlantic City, N. J.
126th Observation Squadron	Fort Dix, N. J.
119th Observation Squadron	Newark, N. J.
Hq. & Hq. Sqdn, 65th Observation Group	Langley Field, Va.
105th Observation Squadron	Langley Field, Va.
112th Observation Squadron	Salisbury, Md.
121st Observation Squadron	Langley Field, Va.
3rd Observation Squadron (Attached Ft. Monroe, Va.)	Langley Field, Va.
Tow Target Detachment	Manchester Air Base, N.H.
Tow Target Detachment	Mitchel Field, N. Y.
Tow Target Detachment	Pope Field, N. C.

5. Refueling points to be established as required at suitable coastal airdromes by groups concerned after co-ordination with this headquarters.

6. Tow target and tracking missions as follows:

a. Camp Davis, N. C. - by Tow Target Detachment, Pope Field.

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S E C R E T

1st Air Support Command
MITCHEL FIELD, NEW YORK
18 DECEMBER 1941

LETTER OF INSTRUCTION)
)
No. 1)

Maps: H.O. 1411, Sectional Aeronautical Charts: 1/500,000.

1. a. The 1st Air Support Command, supporting the First Army, has the following missions in order of priority:

(1) Reconnaissance from the shore line to a line forty (40) miles off shore between Portland, Maine, and a line due east from Wilmington, N. C., for the purpose of locating hostile submarines and surface craft.

(2) Spotting for seacoast artillery.

(3) Towing and tracking missions.

b. In addition, there is the continuing mission of training units of the 1st Air Support Command for field service.

2. Control of operations will be as follows:

a. General - By the Commanding General, First Army, through the Commanding Officer, 1st Air Support Command.

b. Reconnaissance - By the group commanders concerned, in accordance with missions assigned by the 1st Air Support Command. Liaison will be maintained by each group with the Coastal Frontier Sector Commander in whose area they operate. Mission and contact reports to Sector Commanders and this headquarters.

c. Seacoast artillery spotting - By direct arrangement between the Sector Commander and Group Commander concerned.

d. Towing and tracking - By the Commanding General, First Army Anti-Aircraft Artillery Command, in co-operation with the Commanding Officer, 1st Air Support Command.

e. Training of air units - By the Group Commanders, under supervision of this headquarters.

f. Pursuant to oral orders of the Commanding General, First Army, observation units attached to the I, II and VI Army Corps, and the 119th Observation Squadron, are released to control of the 1st Air Support Command.

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b. Chesapeake Sector - By 3rd Observation Squadron, under arrangements between Commanding General, First Army Anti-Aircraft Artillery Command and ~~Commanding General, Ft. Monroe, Va.~~ the Commandant, Coast Artillery School, Ft. Monroe, Va.

c. New York-Philadelphia Sector - By Tow Target Detachment, Mitchel Field, with aircraft and pilots from 59th Observation Group.

d. New England Sector - By Tow Target Detachment, Manchester, N. H., with aircraft and pilots from 26th Observation Group.

7. Communications.

a. Radio - radio nets to be established within each group and between groups and Headquarters, 1st Air Support Command, in accordance with Signal Operations Instructions, to be issued later.

b. Teletype - TWX service to be established between Headquarters, 1st Air Support Command and each group as rapidly as possible.

c. Telephone - Commercial, local and long-distance telephone as required.

d. Messenger - airplane messenger service will be established between each group and this headquarters daily, weather permitting. Messenger planes to arrive at Mitchel Field between 1130 and 1200.

8. Reports.

a. Each group, separate squadron and detachment commander is responsible for co-ordination of aircraft movements with regional information center concerned. (See Annex No. 2, attached - Radiogram.)

b. Contact reports of hostile vessels will be sent to this headquarters and to the Sector Commander concerned, simultaneously, by most rapid means available.

c. Periodic reports (0001 to 2400) by messenger airplane.

9. Reconnaissance aircraft will be armed.

10. Safety precautions in overwater flying.

a. All personnel will wear life vests while engaged in overwater operation.

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Ltr of Instr No. 1, 1st ASC, 12-18-41.

b. Aircraft will be equipped with suitable life raft as rapidly as possible.

c. Provisions of Annex No. 1, herewith, will be followed.

By order of Colonel KEPNER:

JOHN P. DOYLE, JR.,
Major, Air Corps,
Executive.

OFFICIAL:

EDWARD J. CULLETON,
2nd Lt., Air Corps,
Adjutant.

DISTRIBUTION: All Units, 2 ea. 1st ASC (2); First Army (2); First Army Anti-Aircraft Artillery Command (2); First Air Force (2); First Air Force Base Command (2); Air Force Combat Command (2); 1st Interceptor Command (2); 1st Bomber Command (2).

Annex No. 1 - Safety Plan.
Annex No. 2 - Identification of Friendly Aircraft (Radiogram)

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1ST AIR SUPPORT COMMAND,
MITCHEL FIELD, NEW YORK,
18 December 1941.

Annex No. 1

To Accompany Letter of Instructions No. 1

A - SAFETY PLAN

1. The basis of all safety precautions in over water flying is first, a thorough understanding by all personnel of the arrangements made for rescue in the event of forced landing at sea; second, the methodical following of the prearranged plan and third, and perhaps most important, the avoidance of confusion and excitement by all concerned.

2. The U. S. Coast Guard is the primary rescue agency. Calls for assistance should be placed with the Coast Guard Duty Officer in the district in which operating and to the nearest Coast Guard Station. Telephone numbers of the Duty Officers are:

Boston District - Lafayette, 5,800, ext. none. Canadian border to Connecticut line.

New York District - Whitehall 3-3121, ext. 36. Montauk Point to Manasquan, N. J.

Philadelphia District - Market 6,000, ext. 70 (during day; ask for Coast Guard after 4:30 P.M.). Manasquan, N. J. to Fenwick Is. Light.

Norfolk District - Norfolk 2-2771. Fenwick Is. Light to New River, N.C.

Telephone number of the nearest Coast Guard Station is _____ (enter locally). A copy of this plan will be posted at the operations bulletin board by each operating squadron.

Information given to the Coast Guard Agency will be as follows:

a. This is a request for assistance.

b. Identification of the officer calling.

c. Nature of the accident.

d. Location of the accident.

e. Other pertinent information.

Calls to Coast Guard Agencies will be made by the Operations Officer on duty or by the unit commander.

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3. In the event of impending forced landing at sea, the airplane will transmit its call followed by the distress signal Z.F. Call and distress Signal will be repeated as often as possible. Due to procedure outlined under "B" herein, it is not necessary or desirable to attempt to transmit location.

B - OPERATIONS

1. A plotting board will be operated under supervision of a commissioned officer by each organization while airplanes thereof are operating on over water missions. Location, course, speed and time of report will be entered for each unit airplane operating.

2. Except for position reports, contact reports and distress messages as prescribed herein, strict radio silence will be maintained.

3. In the event of radio failure, the airplane will return to the nearest land at once, thence to airdrome.

4. Position reports will be sent each half hour on a schedule to be determined by the commander concerned or on each change of course, whichever occurs first. The following information will be transmitted:

   a. Location by latitude and longitude to the nearest minute of arc. Transmitted as three figure groups omitting the first figure of latitude or longitude.

   b. True course to the nearest whole degree transmitted as a three figure group prefixing zero where necessary.

   c. Ground speed to the nearest mile per hour transmitted as a three figure group.

   d. Time of report by twenty-four hour clock. This is not the time of transmission.

   e. Position reports are identified by the letters TR prefixed to the body of the message.

   f. Example: An airplane at 40° 32' N - 75° 22' W making good a true course of 2 degrees at a ground speed of 143 miles per hour at 2:15 P.M. would send the following report:

TR	032	522	002	143	1415
	Lat	Long	Course	Speed	Time

5. Contact reports of the location of hostile or suspicious objects are sent as follows:

   a. Prefix CR

   b. Identification of the object as: submarine, tanker, cargo vessel, etc.

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at DEBERTE, west of Halifax; NORTH SIDNEY, north of Halifax; and at YARMOUTH, at the southern tip of Nova Scotia.

b. In addition to the above, the Canadians are operating 16 medium bombardment land planes from Newfoundland.

13. Analysis of the present plan of operations for aviation units assigned to the Eastern Theater of Operations, in conjunction with the operations being conducted by the U. S. Navy and the Canadian Air Forces, indicates that the plans of the Commanding General, Eastern Theater of Operations, are sound, and that he is accomplishing all that can be reasonably expected with the airplanes and combat crews which have been made available to him. If possible, a reserve striking force should be formed as rapidly as possible. When additional aircraft and personnel are made available they should be used to form this reserve, rather than to unduly increase patrol service.

14. An analysis of the situation with reference to the United States Army Air Forces discloses that there is an acute shortage of airplanes, pilots, navigators, bombardiers, radio operators, armorers, and aircraft warning personnel throughout the entire theater. The weakness at the present time is a shortage of personnel and equipment, both in the Army and in the Navy. The operations of units are also being hampered by constant changes of personnel, by withdrawing Army cadres from operating units, by using tactical operations stations as staging points for moving personnel overseas, and for forming and training organizations which should be accomplished in the Zone of the Interior.

15. With respect to recommendations for whatever War Department action is required to enable this increased enemy threat to be met adequately, the following are submitted, subject to providing for more urgent requirements:

a. Immediate filling of air units assigned to Eastern Theater with airplanes of standard types, suitable for the tasks required.

b. Immediate furnishing of air force units in this theater with required combat personnel to operate aircraft assigned.

c. Immediate supply of spare parts required for maintenance of equipment.

d. Establish staging areas for overseas and other troop movements at other than Air Corps bases assigned to the Eastern Theater of Operations. The use of Mitchel Field as a staging point is interfering seriously with the tactical operations of that post.

e. Until units assigned to the Theater can be filled with airplanes and personnel, establish a minimum of one bombardment

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Island, and Virginia. These sweeps do not strictly constitute area patrols but are rather designed for the support of shipping. He also maintains a close patrol around Bermuda. In addition, daily and continuous close patrols are being maintained by the Commander of the North Atlantic Naval Coastal Frontier, operating from Boston, New York, and Norfolk; outside the Chesapeake Bay entrance to a radius of 100 miles (south of latitude 37) there is maintained a continuous patrol. Distribution by type is shown in Tab. F.

10. The total number of planes available to the Commander of the North Atlantic Naval Coastal Frontier for his exclusive use is twelve small seaplanes at Boston and twelve at New York. He is assisted or directly reinforced by about ten small planes at Cape May and about eighteen patrol planes at Norfolk, both attached to the Atlantic Fleet; the majority of which are, however, undergoing operational training. These latter are in addition to those in paragraph 9.

11. The Commander-in-Chief, Atlantic Fleet, has a general directive covering offensive action against enemy ships, and is continually given specific information as to enemy activities. This situation was considered in the organization of the Atlantic Fleet. The present enemy actions will result in intensive efforts on the part of both ships and aircraft, the details of which plans are not, at this writing, available in the Navy Department. The Commander-in-Chief, Atlantic Fleet, will undoubtedly employ all of his patrol planes in furtherance of his action. It is recognized that the forces are inadequate to cover completely the North Atlantic Seaboard. However, the forces available are located adjacent to focal points of shipping where the submarine menace can be considered the greatest. The Commander-in-Chief, Atlantic Fleet, is aware of the nature of Army off-shore patrols and can be expected to take these into consideration in his operations.

12. a. The best source of information available (Colonel Bissell) indicated that the Canadian Eastern Air Command is operating in the maritime provinces the following air units:

2 flying boat squadrons	-- 14 planes
2 bomb-reconnaissance, land squadrons	-- 24 planes
1 fighter squadron	-- 15 P-40 type planes
3 coast artillery cooperative detachments	-- 9 planes
1 general reconnaissance operational training unit	-- 36 planes, consisting of 7 Ansons and 29 Hudsons.
1 general reconnaissance school	-- 78 Ansons (2-engine planes)

The center of gravity for operations of planes in the maritime provinces is at Dartmouth, near Halifax. This is an excellent airport which has facilities for both land and seaplane operations. Additional fields are

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3. Details of these plans and status of units are in Tabs A to F, herewith.

4. Close contact and coordination is maintained with the Navy at a Joint Information and Command Headquarters which has been established at 90 Church Street, New York City. All available information is sent to this joint information and control center, where the Bomber Command, the Commanding Officer of the North Atlantic Naval Coastal Frontier, and 3d Naval District, have established their headquarters in conjunction with the Naval headquarters at that place. Decisions can be reached immediately, and instructions issued from this information and command center. This headquarters has direct telephone communication with the headquarters of the 1st Air Force, and through the 1st Interceptor Command with Halifax, Nova Scotia. Halifax, Nova Scotia, has direct teletype connection with St. John's, New Foundland; from which point TWX messages are relayed to the Newfoundland Airport. In addition, the 1st Air Force Headquarters has direct telephone communication with the Air Force Combat Command Headquarters at Bolling Field and with the 3d Air Force Headquarters at Tampa, Florida. This gives a complete direct and instantaneous communication between the interested defensive agencies in the Eastern area.

5. Joint Canadian and United States defense operations are covered in Joint Plan ABC-22, which was put into effect immediately upon the declaration of war. This plan provides for the coordination of military efforts between the United States and Canada by mutual cooperation and by assigning to the forces of each nation tasks for whose execution such forces shall be primarily responsible.

6. At the present time, close liaison and direct communication is maintained between the Commander of the Eastern Theater of Operations and the Canadian Eastern Air Commander.

7. Orders issued by The Adjutant General, December 30, 1941, file AG 320.2 (12-30-41)MC-M, subject: "Allocation of Army Aircraft Units and Associated Services and the Assignment of Air Bases and Airdromes", made a definite assignment of units to the Eastern Theater of Operations. This assignment withdrew a number of aviation units from that theater for other assignments, particularly to the Air Force Combat Command. This assignment left only three pursuit groups (less one squadron), two medium bombardment groups, one heavy bombardment group, and four observation groups in the Eastern Theater of Operations. Details of airplanes and combat crews strength of these units are shown on Tab. B.

8. The operations being undertaken and the location of units are shown on situation map, attached herewith, marked Tab. A.

9. The Navy is operating in this area in general as follows: Long-range patrol planes, operating directly under the Commander-in-Chief, Atlantic Fleet, are carrying out sweeps for the protection of the offshore sea lanes and convoys from bases in Iceland, Newfoundland, Rhode

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GENERAL HEADQUARTERS, U. S. ARMY
ARMY WAR COLLEGE
WASHINGTON, D. C.

S E C R E T
Auth: CG, GHQ
Initials: WHW
Date: 1-15-42

IN REPLY REFER TO:
381-ETO-Avn
(1-15-42)

January 15, 1942.

SUBJECT: Preparation of Eastern Theater of Operations to Combat Hostile Surface and Sub-surface Activities.

TO: Deputy Chief of Staff for Air, Office of the Chief of Staff, War Department, Washington, D. C.

1. Reference your memorandum, above subject, January 14, 1942, this headquarters has investigated the plan of the Commander of the Eastern Theater of Operations for operations against hostile surface and sub-surface activities and the adequacy of this plan to meet this threat.

2. a. In general, the plan now in operation is to use all available means for reconnoitering the area to the east of the Atlantic coast line, between the northern tip of Maine and the Cape Hatteras, to the maximum range of bombardment and reconnaissance aircraft available to the Theater Commander. Bombardment airplanes carry bombs or depth charges for attacking submarines. This distant reconnaissance is supplemented by using all available observation aircraft for reconnoitering to a distance of approximately forty (40) miles from the shore. Interceptor aviation is maintained on alert for possible use against enemy air raids.

b. With respect to reconnaissance operations at sea, present equipment permits the performance of the following missions from the bases indicated:

Four (4) patrol missions daily from Bangor.
Eight (8) patrol missions daily from Westover.
Five (5) patrol missions from Mitchel Field.
Four (4) patrol missions daily from Langley Field.

c. In addition to the above, available equipment and personnel permits retaining a striking force available using personnel on rest periods at each base of approximately the following crews and airplanes:

Four (4) at Bangor.
Four (4) at Westover.
Three (3) at Mitchel Field.
Five (5) at Langley Field.

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FIRST AIR FORCE - EASTERN THEATER OF OPERATIONS
Summary of Airplanes & Combat Crew Status

UNITS	AIRPLANES		PILOTS			NAVIGATORS OR OBSERVERS	BOMB	RADIO OPERATORS	REMARKS
B & Rec	TOTAL	IN COM	4 ENG	2 ENG	OTHERS				
43 B Gp	6 A-29) 3 7 LB-30) 4		4	8	3	0	4	7	Bangor, Me.
13 Rec Sq	9 A-29	6	3	4	6	1	0	7	Bangor, Me.
34 B Gp	4 LB-30	3	9	8	0	5	2	12	Westover Fld.
1 Rec Sq	8 B-18) 7 1 LB-30) 0		8	2	1	3	4	11	Westover Fld.
20 B Gp	11 B-25) 4 5 B-18) 5 2 B-17) 1		1	14	0	4	3	7	Mitchel Fld., (From 2d B Gp)
2 B Gp	7 B-17) 4 3 B-18) 3 2 B-17E) 2		8	22	3	8	3	2	Langley Fld., less 2 Sqs, 49th B Sq less airplanes & combat crews in Nfld.
41 Rec Sq	6 B-17B	?	?	?	?				Newfoundland.
PURSUIT									
57 Gp Hq									
64 Sq	8	?		7					Boston
65 Sq	2	?		1					Groton
Training Det	13	?		5 Pilots 12 Trainees					
66 Sq	9			6					Windsor Locks.
Det of 8th Pur	9			9					Farmingdale
33 Gp Hq	8			9					Mitchel Fld.
59 Sq	12			9					(Ordered Away) Philadelphia, Pa.
60 Sq	14			13					Glenn Martin Plant.
56 Gp	47	26 Combat		60					Bolling Fld, D.C. Now in Carolinas being transferred to New York Area.

B

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FIRST AIR FORCE - EASTERN THEATER OF OPERATIONS
Summary of Airplanes & Combat Crew Status
(Continued)

UNITS	AIRPLANES		PILOTS			NAVIGATORS OR OBSERVERS	BOMB	RADIO OPERATORS	REMARKS
Hq Sq 1st	TOTAL	IN COM	4-ENG	2-ENG	1-ENG OTHERS				
ASC.	2 C-40A	2			7*	0*			Mitchel Fld, NY
Hq Sq 26th Obsn.Gp	1 O-46A	1			4*	1*			Hillsgrove, RI
	1 O-47B	1							
101st Obsn Sq	2 O-46A	2			16*	15*			Camp Edwards, Mass.
	2 O-47A	2							
	3 O-49	3							
	1 O-49A	1							
	3 O-52	2							
	1 YO-57	1							
	3 O-59	2							
103rd ObsnSq	3 O-46A	3			15*	12*			Hillsgrove, RI
	1 O-47B	1							
	2 O-49	2							
	1 YO-57	0							
152nd Ob Sq	2 O-47A	2			16*	7*			Fort Devens, Mass.
	2 O-49	2							
	7 O-52	5							
	2 O-58A	1							
Hq Sq 59 ObGp.	1 C-45	1			1*	4*			Fort Dix, NJ
104th Ob. Sqdn.	6 O-46A	4			13**	11**			Atlantic City,NJ
	2 O-47A	1							
	1 O-47B	0							
	3 O-49	2							
	3 YO-59	3							
119th Ob Sqdn.	1 O-47A	1							Newark, NJ
	3 O-49	0							
	10 O-52	5							
	1 YO-58	0							
126th Ob Sqdn.	1 BC-1A	0							Fort Dix, NJ
	1 O-46A	1							
	1 O-47A	1							
	3 O-49	2							
	2 O-59	2							

NOTE: * As of December 31
** As of October 31

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FIRST A FORCE - EASTERN THEATER OF OPE TIONS
Summary of Airplanes & Combat Crew Status
(Continued)

UNITS	AIRPLANES TOTAL	AIRPLANES IN COM	PILOTS 4-ENG	PILOTS 2-ENG	PILOTS 1-ENG OTHERS	NAVIGATORS OR OBSERVERS	BOMB	RADIO OPERATORS	REMARKS
Hq Sq 65th Ob Gp					1**	0**			
105th Ob Sqdn.	1 O-47B	1			10**	6**			Langley Fld, Va.
	2 O-49	2							
	1 O-49A	1							
	10 O-52	10							
	3 O-57	3							
112th Ob Sqdn.	5 O-47A	5			13**	16**			Dover, Del.
	3 O-49	3							
	2 O-57	2							
	1 YO-57	1							
	3 O-58A	3							
121st Ob Sqdn.	1 AT-6	1			12**	6**			Langley Fld, Va.
	1 O-38E	1							
	1 O-47B	1							
	3 058	3							
3rd Ob Sqdn.	2 B-10BM	1			23**	?**			Langley Fld, Va.
	6 O-47A	4							
	3 O-49	1							
	2 O-52	1							
Tow Tar Det.	2 B-10BM	2							Manchester, NH
	2 O-58A	2							
	2 O-59	1							
Tow Tar Det.	1 B-10BM	1							Mitchel Fld, NY
	4 O-58A	3							
Tow Tar Det.	3 B-10BM	2							Pope Fld, NC
	2 PT-17	2							
2nd Balloon Sqdn.	2 C-6	1							Fort Bragg, NC

NOTE: * As of December 31
** As of October 31

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HEADQUARTERS FIRST BOMBER COMMAND
ADVANCED ECHELON
90 Church Street
New York, N. Y.

January 14, 1942.

C

SUBJECT: Report of Personnel and Equipment Available for Submarine Patrol.

TO: Commanding General, First Air Force, Mitchel Field, New York.

1. Methods of Procedure:

a. Units are operating from bases at Bangor, Maine; Westover Field, Massachusetts; Mitchel Field, New York and Langley Field, Virginia, covering areas shown on attached chart.

b. Courses flown are shown on attached chart whenever weather and training of personnel permit.

2. Analysis of Aircraft and Personnel:

a. Bangor:

(1) 43rd Bomb Group:

Aircraft: 6 A-29's assigned; average 3 in commission; 3 out due to lack of spare parts.

7 LB 30's assigned; 4 in commission; 3 out due to lack of spare parts.

Personnel:

4	Four-engined pilots
8	Two-engined pilots
3	Copilots
0	Navigators
4	Bombardiers
7	Radio Operators

From the above personnel can be formed four (4) combat crews complete less navigators, and three additional crews without either navigators or bombardiers.

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Report of Personnel and Equipment Available for Submarine Patrol.

(2) 13th Reconnaissance Squadron:

Aircraft: 9 A-29's assigned; 6 in commission, three out of commission

Personnel:

3	Four-engined pilots
4	Two-engined pilots
6	Copilots
1	Navigator
0	Bombardiers
7	Radio Operators

From the above personnel can be formed six (6) combat crews; all less bombardiers and only one (1) with a navigator.

(3) Discussion of Capabilities:

(a) Units at Bangor have been cadre units until very recently, in fact, the 13th Reconnaissance Squadron has at present assigned 140 enlisted men including those on detached service. This is its greatest strength since organized. Approximately three weeks ago there were assigned the first group of trainees from the flying school of which more than half have already been drawn for task force units. This group of trainees consisted of eleven (11) untrained pilots. Within the past three weeks these units have lost all navigators, bombardiers and other combat crew members except those listed in the table above to task force units.

(b) It is essential due to the area required to be covered on patrol that a unit operate from the Bangor Air Base. Operations from this base during Winter months are so difficult that scheduled times for take-off cannot be made because of difficulties in starting the engines. As a result, the average number of available airplanes on patrol is approximately one-half those available for this duty.

(c) Due to the relative inexperience of all personnel, both combat crews and maintenance, numerous difficulties are encountered in attempting any operations. It is necessary

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to use considerable caution in analyzing weather forecasts because of prevalent icing conditions and the pilot's lack of experience in flying Winter weather over the North Atlantic. It will be noted that many patrols accomplished by these crews are without navigators.

(d) The 13th Reconnaissance Squadron is under orders to sail for foreign service on January 20 and has been relieved from all patrol. The 43rd Bomb Group is under warning orders and will be relieved as soon as definite date of movement has been received.

b. Westover Field:

(1) 34th Bomb Group:

Aircraft: 4 LB 30's assigned; 3 in commission; 1 out of commission indefinitely.

Personnel:

9	Four-engined pilots
8	Two-engined pilots
0	Copilots
5	Navigators
2	Bombardiers
12	Radio Operators

(2) 1st Reconnaissance Squadron:

Aircraft: 8 B-18's assigned; 7 in commission;
1 LB-30 assigned - out of commission indefinitely.

Personnel:

8	Four-engined pilots
2	Two-engined pilots
1	Copilot
3	Navigators
4	Bombardiers
11	Radio Operators

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Report of Personnel and Equipment Available for Submarine Patrol.

From the above units it is possible to form fourteen (14) combat crews of which only eight (8) will have navigators and six (6) bombardiers.

(3) Discussion of Capabilities:

(a) The units at Westover are considerably better qualified both in combat crew personnel and maintenance personnel than those at Bangor because they have been on a higher priority than the Bangor units.

(b) The 1st Reconnaissance Squadron which is conducting patrol in the area assigned to the Westover units is being augmented by combat crews from the 34th Group. This unit is conducting very effective patrol in spite of difficult flying weather and cold weather interference with maintenance.

c. Mitchel Field:

(1) 20th Bomb Squadron:

Aircraft: 11 B-25's assigned; 4 in commission.
5 B-18's assigned; all in commission.
2 B-17's assigned; 1 in commission.

(The B-25 airplanes have not stood up under cold weather operations and all have been grounded awaiting new gasoline booster pumps, breaker points and other engine assemblies.)

Personnel:

1 Four-engined pilot
14 Two-engined pilots
) Copilots
4 Navigators
6 Bombardiers
7 Radio Operators

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Report of Personnel and Equipment Available for Submarine Patrol.

While this squadron can physically form ~~fourteen (14)~~ seven (7) combat crews less the shortages of navigators and bombardiers only six (6) are considered as being available because of squadron overhead.

(2) Discussion of Capabilities:

(a) This squadron can operate a total of six (6) crews for which airplanes are available but that for only a short period of time due to fatigue of personnel. This squadron has been operating continuously at Mitchel Field since December 9, 1941 without adequate rest or recreation. It is now in a condition where the complete squadron should be given at least a 10 day rest period prior to any further strenuous operations.

(b) The difficulties encountered in accomplishing maintenance without adequate hangar space requiring that a great deal of the work be accomplished in dispersed positions under freezing weather conditions has greatly limited the efficiency of this unit.

(c) The B-25 airplanes do not have sufficient range for accomplishing patrol ~~and~~ while carrying a bomb load.

d. Langley Field:

(1) 2nd Bomb Group:

Aircraft: 7 B-17's assigned; 4 in commission
3 B-18's assigned; all in commission
2 B-17E's assigned; all in commission

Personnel:

8 Four-engined pilots
22 Two-engined pilots
3 Copilots
8 Navigators
3 Bombardiers
2 Radio Operators.

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Report of Personnel and Equipment Available for Submarine Patrol.

(2) Analysis of Capabilities:

(a) This Group has only one operating squadron under its control at Langley Field. The 20th Bomb Squadron has been detached and is operating at Mitchel Field. The 49th Bomb Squadron has been under various movement orders and is literally scattered all over the United States.

(b) This Group is capable of furnishing eight (8) four engined crews and sufficient additional two-engined crews to operate all available aircraft. As can be noted from the above figures these crews will not all be equipped with navigators or bombardiers or qualified radio operators.

3. Resume of Patrol Capabilities:

(a) It has been found necessary to have 30% more crews available than there are aircraft in order to provide rest periods to prevent excessive fatigue of personnel. Past performances indicate that we can expect -

4	Patrol	missions	daily	from	Bangor
8	"	"	"	"	Westover
5	"	"	"	"	Mitchel
4	"	"	"	"	Langley

(b) This allows a striking force available at each base at all times of approximately the following number of crews and airplanes:

4 at Bangor
4 at Westover
3 at Mitchel
5 at Langley

(c) Unless a change in status of personnel occurs it is expected that the amount of patrol and striking force as listed above will be available to the First Bomber Command for the next several days.

For the Commanding General:

D. R. Lyon

D. R. LYON
Major, A. C.,
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HEADQUARTERS FIRST INTERCEPTOR COMMAND
New York, New York

January 14, 1942

MEMORANDUM FOR Colonel Ralph H. Wooten, AC
Air Officer
GHQ

D

This Command has been called upon to furnish approximately 23 officers and 250 enlisted men, all specialists in the operation of SCR 270 radio detectors. Providing this personnel has left in the First Interceptor Command area, two officers and ten enlisted men who can operate derax equipment but who are not qualified in maintenance, tuning and repair. It is believed that the Third Interceptor Command area has two officers and thirteen enlisted men with similar training.

This Command is now called upon to provide three Reporting Companies, Aircraft Warning, at a total approximate strength of 30 officers and 640 enlisted men.

The operation of RDF equipment is a highly technical job which requires an electrical engineer who has attended an Aircraft Warning Service school to set up the equipment and tune the antennae during a period of two days before any reliability can be placed in the information picked up by the set. If this command furnishes the four officers and twenty-three enlisted men mentioned above in the First and Third Interceptor Command areas, it is doubted whether they will be able to set up, tune, operate and repair equipment at any destination to which they may be sent. In the past it has often been necessary to procure the services of a specialized engineer from the Fort Monmouth School in order to tune equipment and make it operate satisfactorily.

If these four officers and twenty-three enlisted men are withdrawn, it will be necessary to close down all derax stations and withdraw the equipment.

In reference to the three plotting platoons of these companies, the only qualified personnel to form a nucleus for these platoons are now distributed at the Boston, New York, Philadelphia, Baltimore and Norfolk Information and Filter Centers. This personnel plots and filters reports during the period midnight to six A. M. to relieve

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Memo for Colonel Wooten, 1/14/42

volunteers of duties during these hours. This personnel is also required at these Centers to serve as instructors for the civilian volunteers of which there is a constant turnover and who must be trained. If this personnel is removed from Information and Filter Centers, the training of civilian personnel will be seriously curtailed if not altogether stopped.

The entire situation of personnel to operate SCR 270 equipment has been in the process of organization since April, 1941, when a definite need for personnel of this type was foreseen and action requested by the War Department to take steps to provide personnel and establish training. In October, 1941, a board of officers was appointed to review the entire personnel and training situation. After this board proceeding, inexperienced personnel were assigned to three Signal Regiments and two separate Battalions which were activated about December 15, 1941, with the result that training is just beginning. On January 5, 1942 the three Signal Regiments and separate Battalions were removed from the control of the Eastern Theater of Operations and assigned to the Air Force Combat Command, thereby making it impossible for this headquarters to draw on the few trained personnel which these units have.

A possible solution to the urgent need for detector personnel may exist in the fact that antiaircraft units are assigned and operate SCR 268 equipment which is similar to the 270 equipment. It is believed that personnel trained on SCR 268 can be readily converted to operate SCR 270 equipment.

Note: This statement received by telephone from Major Bulger, First Interceptor Command.

Additional Notes

This Command has just received warning orders to activate the 657th, 607th, 608th, 609th, 610th and 611th Reporting and Plotting Companies for operation in the Boston, New York, Philadelphia, Norfolk, Buffalo and Albany regions. Upon the commencement of hostilities this headquarters had organized detachments which were doing the work of the Reporting and

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Additional Notes, Colonel Wooten, 1/14/42

Plotting Companies. These detachments have been withdrawn as cadres for other units already activated and ordered out of this area. There remains no trained personnel from which to form cadres to activate these new units other than the 551st Signal Battalion (separate) recently organized at Camp Dix and totally untrained.

Aircraft and pilot status is as follows:

Disposition of groups and squadrons assigned to this command

At Boston - 57th Group headquarters and 64th Squadron, strength 8 airplanes and 7 pilots

At Groton - 65th Squadron, strength 2 airplanes and 1 pilot

At Windsor Locks - A training detachment consisting of 13 airplanes and 5 officers training 12 new trainees

Combat strength of the Boston Region - 17 operating airplanes

At Farmingdale - 66th Squadron, strength 9 airplanes and 6 pilots

At Mitchel Field - A detachment of the 8th Pursuit Group can provide 9 combat airplanes operating from that station

Withdrawal of the 8th Pursuit Group has been made and the 56th Pursuit Group has not arrived as replacement in the New York Region, leaving the combat strength in this Region at 12 airplanes

At Philadelphia - 33rd Group Headquarters and Headquarters Squadron, strength 8 airplanes and 9 pilots

At Glenn Martin Airport - 59th Squadron, strength 12 airplanes and 9 pilots

At Bolling Field - 60th Squadron, strength 14 airplanes and 13 pilots

Combat strength of the Philadelphia Region - 24 airplanes available for combat

The 52nd Group has been withdrawn from Norfolk, Langley Field and Floyd Bennett Field

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Additional Notes, Colonel Wooten, 1/14/42

The 56th Group which is scheduled to move into the New York Region is disposed as follows:

At Charleston - Headquarters Squadron and 61st Squadron, strength 21 airplanes and 23 pilots

At Wilmington - 62nd Squadron, strength 16 airplanes and 20 pilots

At Myrtle Beach - 63rd Squadron, strength 10 airplanes and 19 pilots

Combat strength of the Charleston-Wilmington Region (56th Pursuit Group) - 26 combat airplanes

The grand total of airplanes that the above units can put into the air for combat, balancing airplanes in commission and pilots, is 79. Sixty-four per cent of the airplanes assigned are in commission.

On the P-39 airplanes the 37 mm. cannon are not functioning due to a weakness in the gun mount which causes the gun to break from its mount when fired. The only thing which prevents the gun from coming into the cockpit is the front armor plate. On the P-39 airplanes the wing guns cannot be controlled from the cockpit due to malfunctioning or poor design in the remote control charging mechanism, necessitating that guns be charged with a round in the chamber before leaving the ground. Any stoppages that occur in the air cannot be released as the pilot has no control over the charging mechanism.

Groups are seriously handicapped by lack of armament personnel for the maintenance of machine guns due to the withdrawal of 80 armorers for assignment elsewhere who have not been replaced. Training of combat units has been seriously handicapped by the withdrawal of 62 pilots for permanent transfer.

There is a marked shortage of capable and trained personnel in radio operation and maintenance. Activation of Interceptor Control Squadrons requires a tremendous number of radio personnel which are not available.

Aerial gunnery training has been seriously handicapped by lack of butts for shooting in guns and adjusting sights, also lack of ground ranges at which pilots may fire and gain instruction in sighting and aiming and competence in placing bullets where they aim them.

Instrument flying is practically at a standstill due to a shortage of trainer type aircraft, unavailability of Link trainers, and lack of

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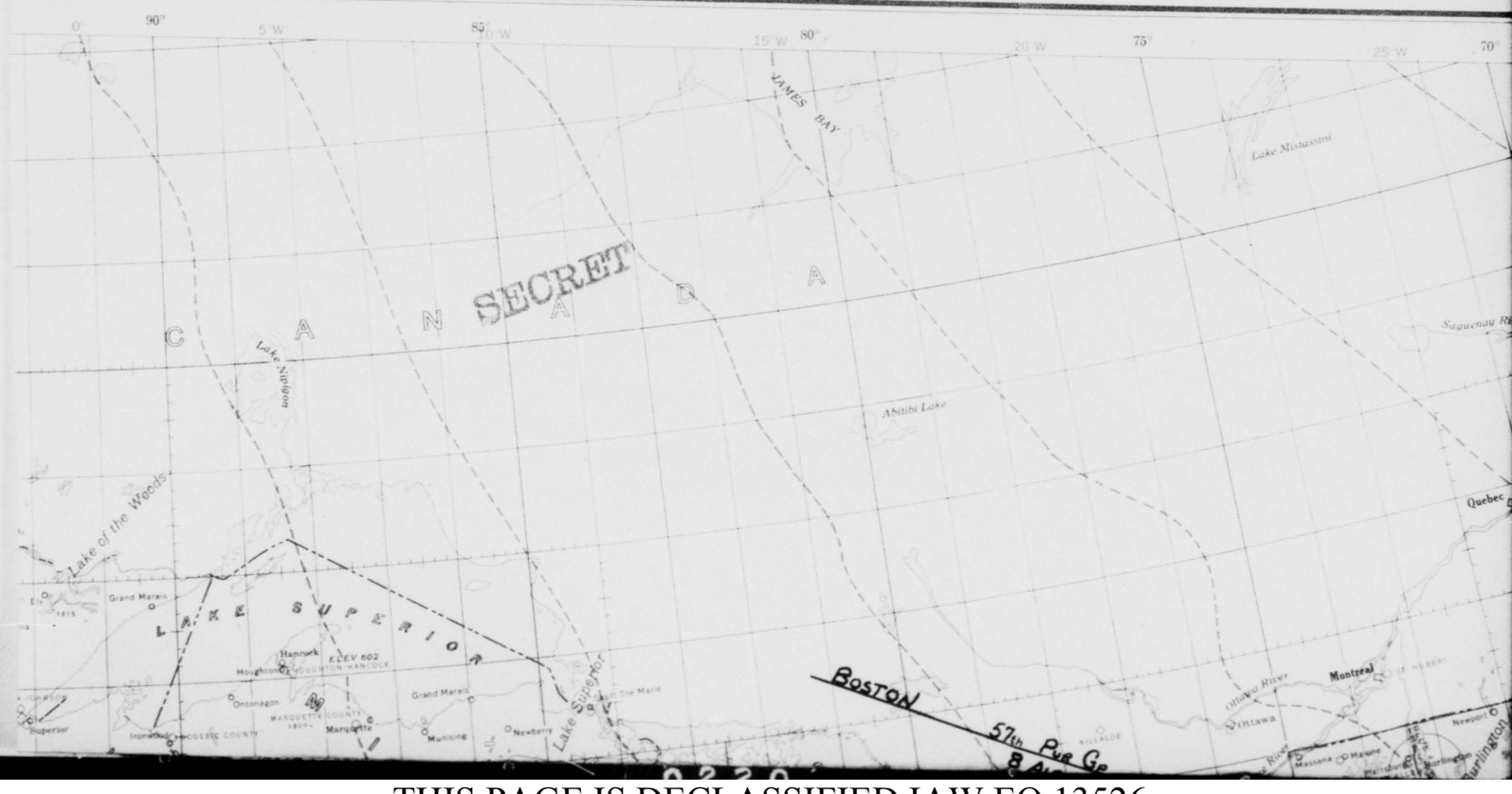

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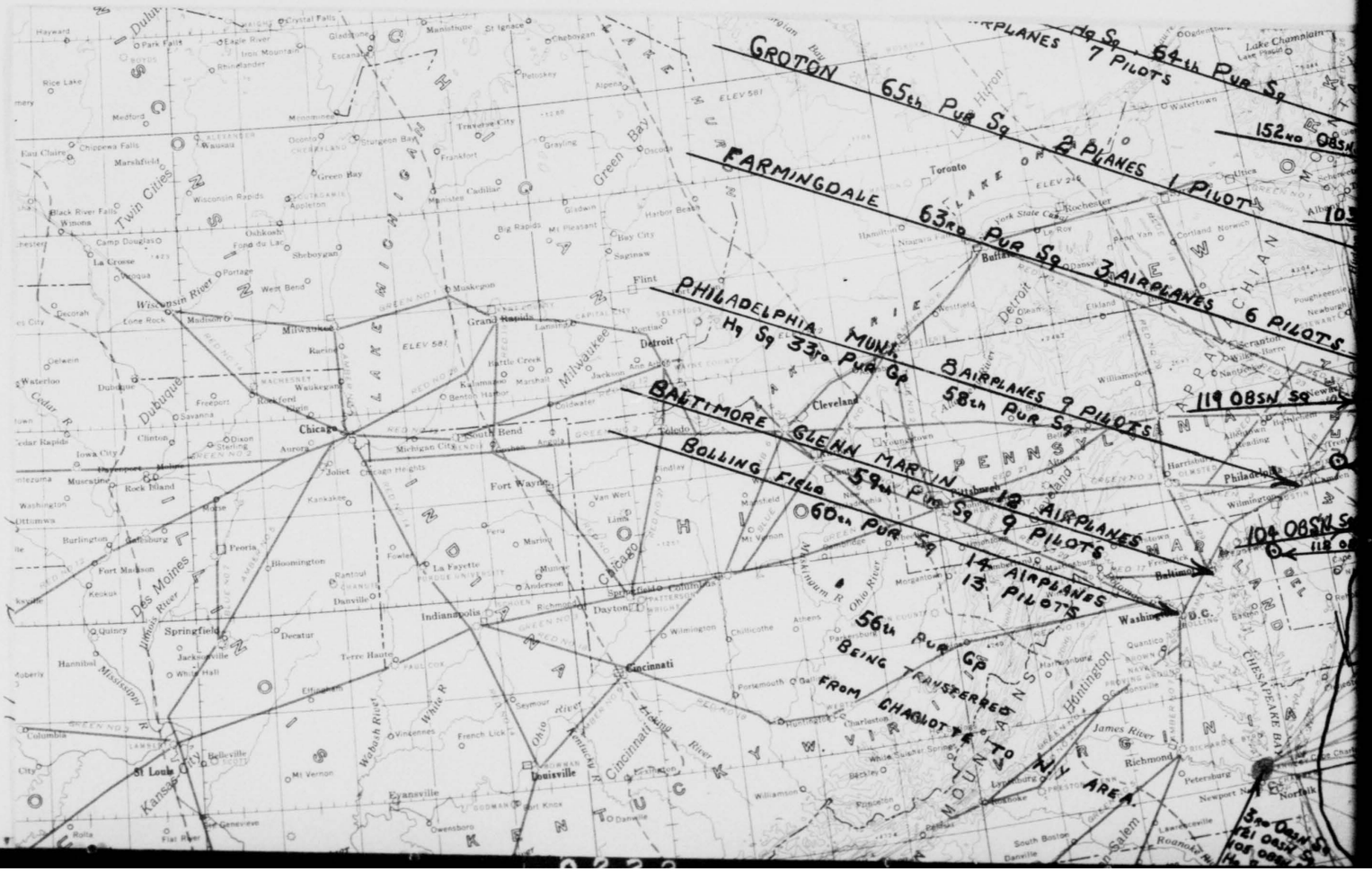

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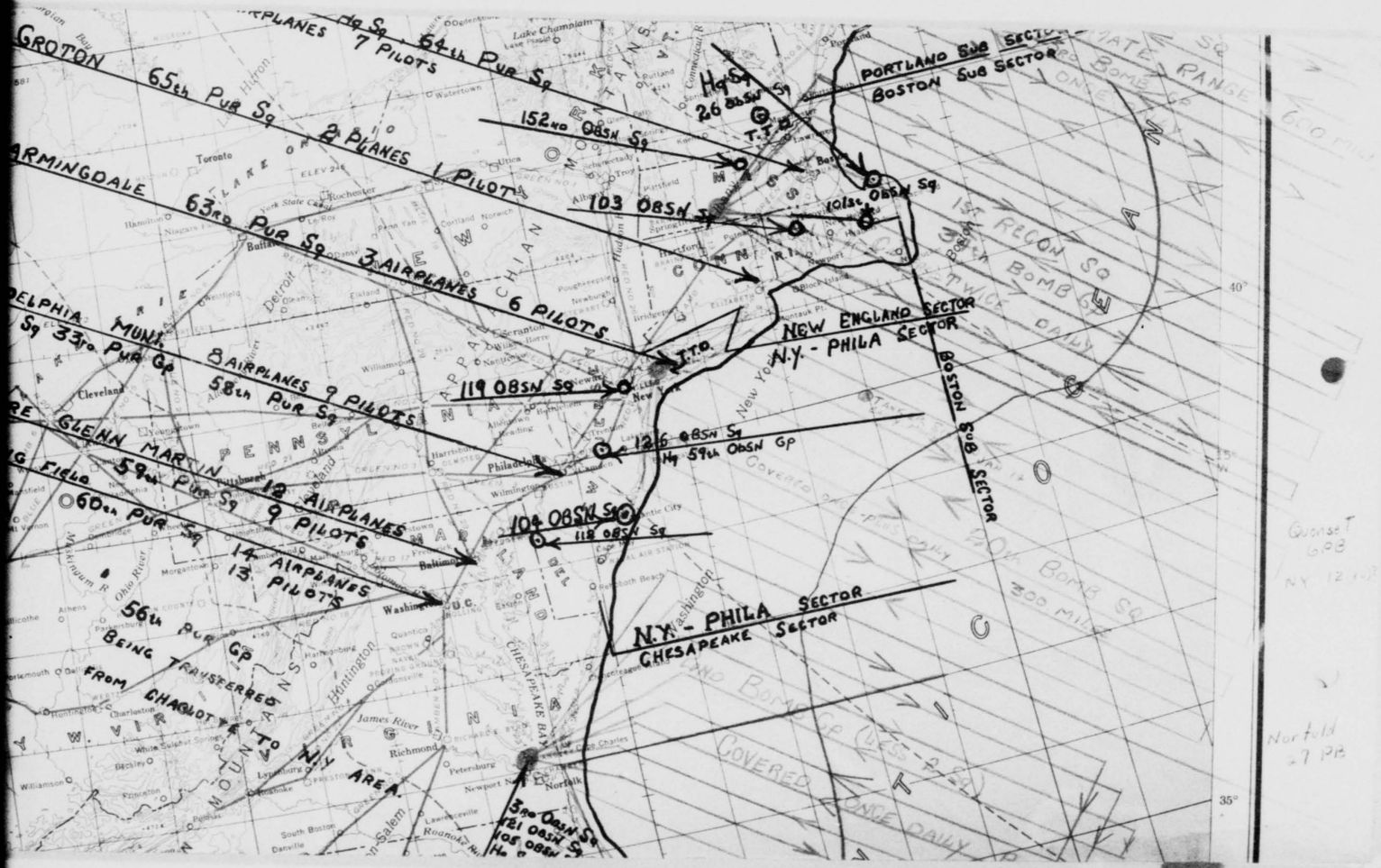

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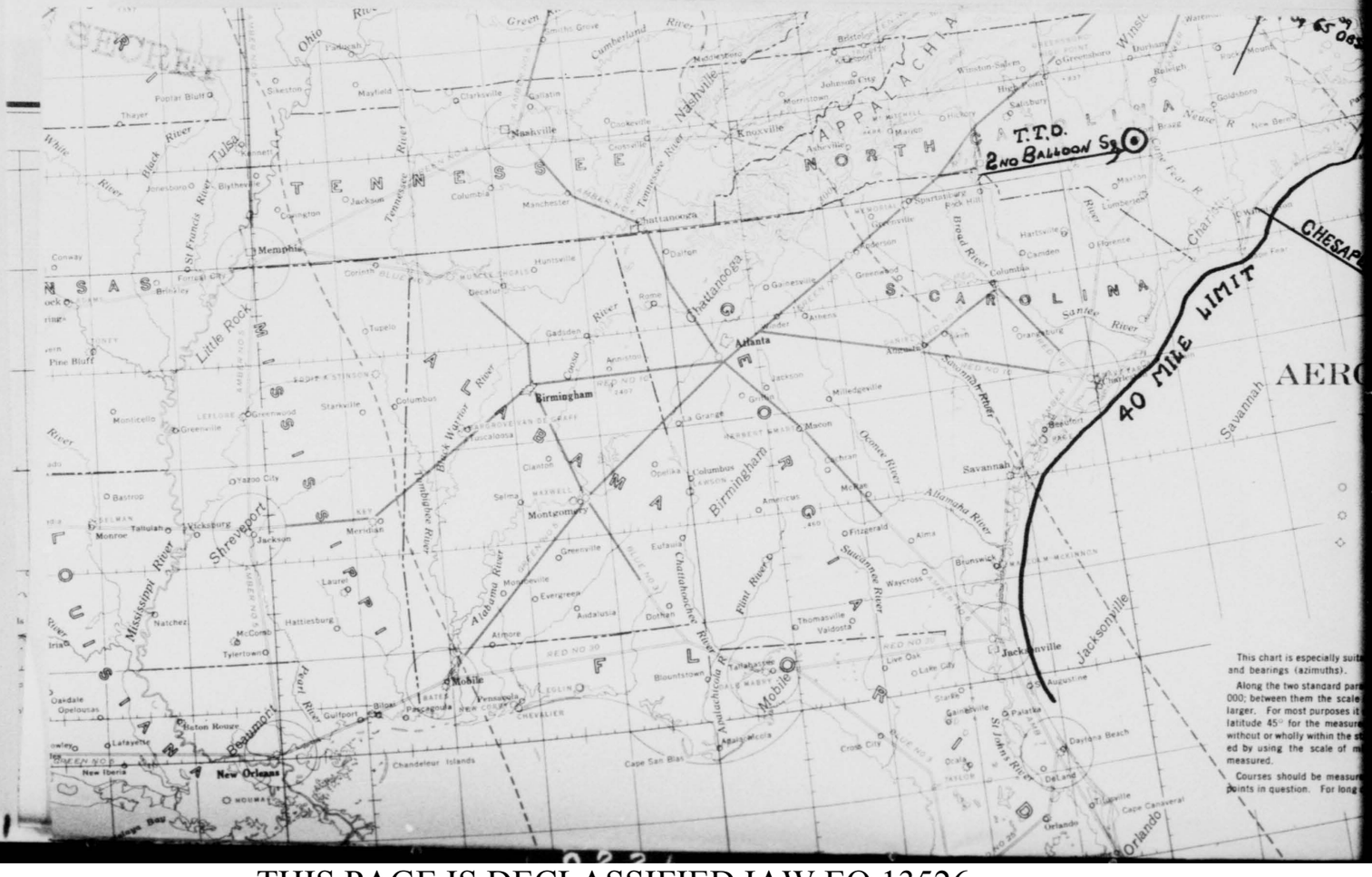
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AERO
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Atlanta
Birmingham
Chattanooga
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Mobile
New Orleans
Shreveport
Jacksonville
Orlando
Savannah
Tulsa
Little Rock
Montgomery
Meridian
Tallahassee
Pensacola
Gulfport
Beaumont
Lafayette
Baton Rouge
Columbus
Macon
Augusta
Charleston
Wilmington
Raleigh
Greensboro
Winston-Salem
Asheville
Greenville
Spartanburg
Columbia
Florence
Charlotte
Durham
Norfolk
Richmond
Roanoke
Lexington
Louisville
Evansville
Paducah
Cincinnati
Dayton
Columbus
Toledo
Cleveland
Akron
Youngstown
Pittsburgh
Erie
Buffalo
Rochester
Syracuse
Albany
Utica
Binghamton
Scranton
Wilkes-Barre
Allentown
Reading
Harrisburg
Philadelphia
Trenton
Atlantic City
Wilmington
Baltimore
Washington
Annapolis
Salisbury
Dover
Cape May
Ocean City
Virginia Beach
Newport News
Hampton
Petersburg
Lynchburg
Danville
Martinsville
Bristol
Johnson City
Kingsport
Morristown
Cookeville
Clarksville
Hopkinsville
Bowling Green
Owensboro
Evansville
Terre Haute
Indianapolis
Fort Wayne
South Bend
Gary
Chicago
Milwaukee
Madison
Green Bay
Duluth
Minneapolis
St. Paul
Rochester
La Crosse
Eau Claire
Wausau
Marquette
Sault Ste. Marie
Mackinaw City
Traverse City
Saginaw
Bay City
Flint
Detroit
Ann Arbor
Lansing
Grand Rapids
Kalamazoo
Battle Creek
Jackson
Muskegon
Benton Harbor
Michigan City
Peoria
Springfield
Decatur
Champaign
Danville
Bloomington
Rockford
Joliet
Aurora
Elgin
Waukegan
Kenosha
Racine
Milwaukee
Green Bay
Appleton
Oshkosh
Fond du Lac
Sheboygan
Manitowoc
Two Rivers
Kewaunee
Door Peninsula
Escanaba
Iron Mountain
Menominee
Marinette
Oconto
Rhinelander
Wausau
Stevens Point
Wisconsin Rapids
Marshfield
Eau Claire
Chippewa Falls
Rice Lake
Hayward
Ashland
Superior
Duluth
Hibbing
Virginia
International Falls
Grand Rapids
Bemidji
Brainerd
St. Cloud
Minneapolis
St. Paul
Rochester
Austin
Albert Lea
Mankato
New Ulm
Worthington
Sioux Falls
Yankton
Vermillion
Sioux City
Council Bluffs
Omaha
Lincoln
Grand Island
Hastings
Kearney
North Platte
Scottsbluff
Alliance
Chadron
Rapid City
Pierre
Aberdeen
Watertown
Huron
Mitchell
Yankton
Sioux Falls
Brookings
Watertown
Fargo
Grand Forks
Devils Lake
Minot
Williston
Dickinson
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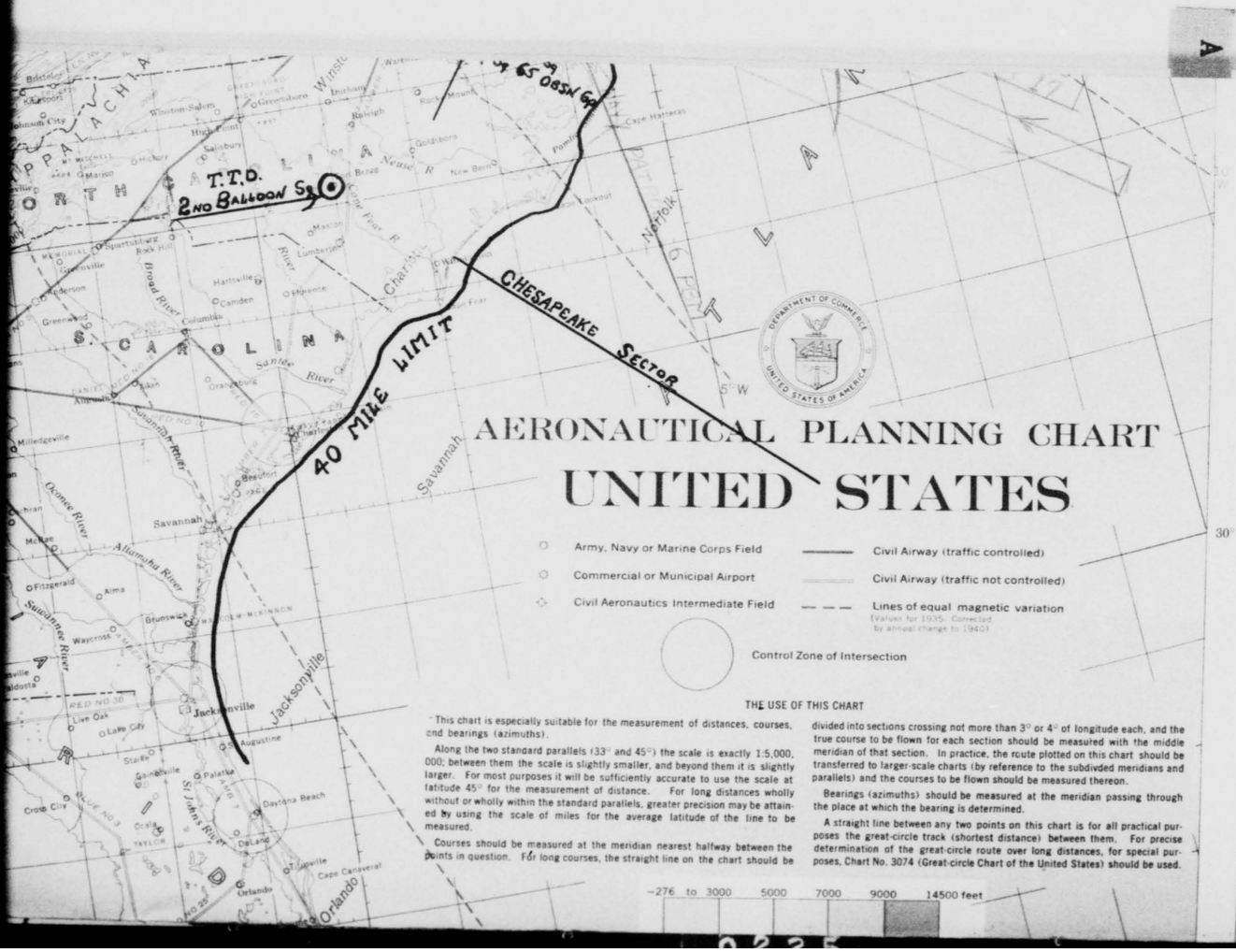

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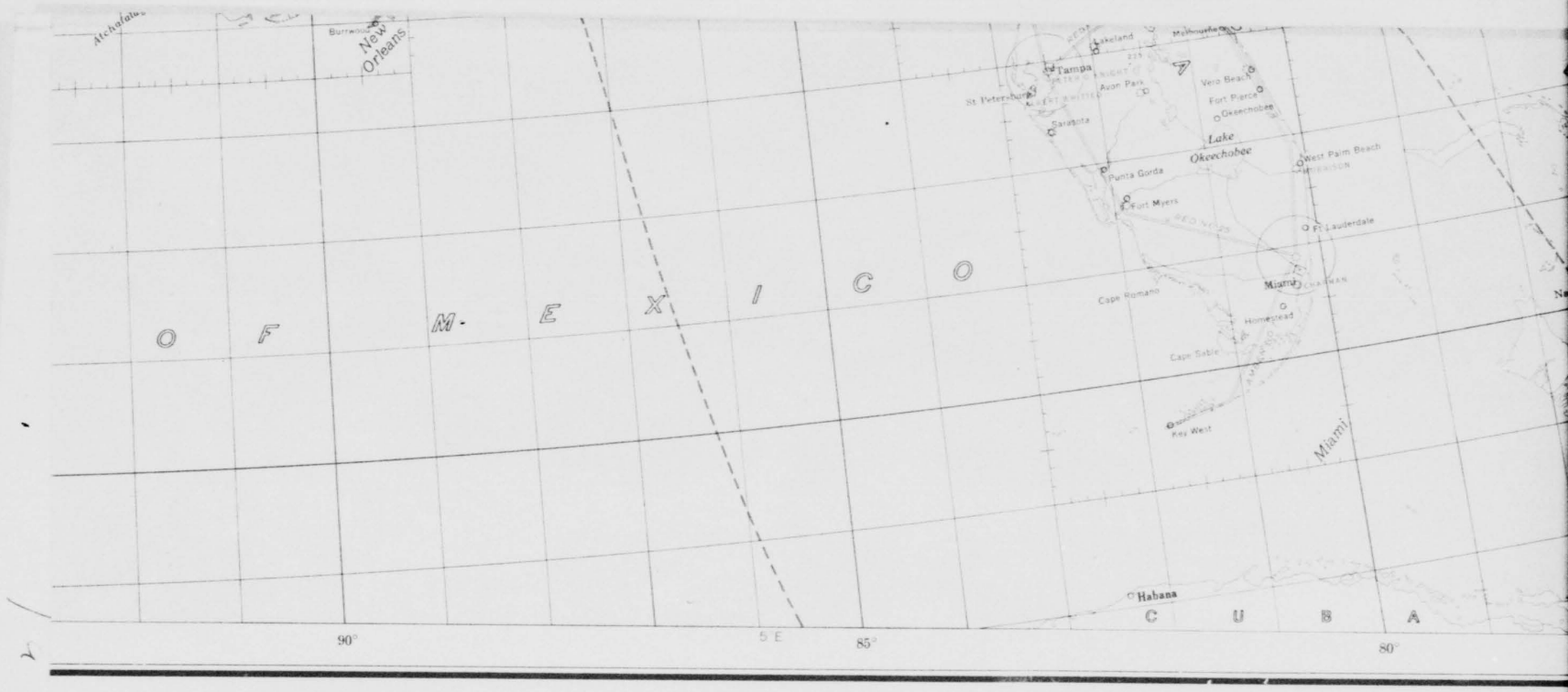

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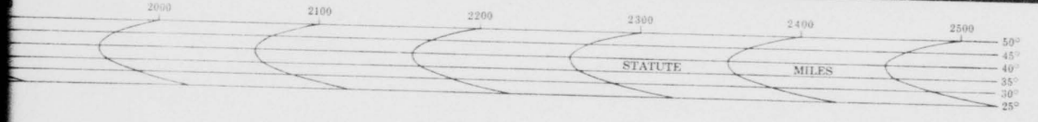

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group on a training basis in the Northeast area, which will be available as a reserve on call from the Eastern Theater Commander for reinforcing this Theater, including Bermuda and Newfoundland.

f. Replace and supplement present observation planes assigned to observation units with A-20 type light bombardment planes which will be suitable also for attacking submarine targets and for operations at greater distances from the shore.

16. Report on the Western Defense Command operations plan will be forwarded as soon as received and analyzed.

For the COMMANDING GENERAL:

J. W. Ramsey

JAN 16 1942

J. W. [illegible]
Asst.

WAR DEPARTMENT
OFFICE OF CHIEF OF STAFF

8 Inclosures:
Tab. A - Situation Map
Tab. B - Airplane and Combat Crew Status, 1st AF
Tab. C - Report of Personnel & Equip, 1st Bomb Comd.
Tab. D - Report fr 1st Interceptor Comd.
Tab. E - Present Opns of 1st Air Sup Comd.
Tab. F - Naval Shore-Based Aircraft in ETO.
Tab. G - AF Communications, NY to Newfoundland.
Tab. H - Signal Reporting Companies, 1st AF.

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c. Location, course and speed of the vessel and time of observation as prescribed for position reports.

d. Example: If an unidentified submarine was located at the position given above making a speed of 15 miles per hour on a course of 41 degrees at 2:15 P.M., the following report would be sent:

CR Unidentified submarine 032 Lat 522 Long 041 Course 015 Speed 1415 Time

6. * ~~Secrecy provisions and downgrading data.~~

By order of Colonel KEPNER:

JOHN P. DOYLE, JR.,
Major, Air Corps,
Executive.

OFFICIAL:

EDWARD J. CULLETON,
2nd Lt., Air Corps,
Adjutant.

DISTRIBUTION: All Units 2 cs, 1st ASC (2); First Army (2); First Army Anti-Aircraft Artillery Command (2); First Air Force (2); First Air Force Base Command (2); Air Force Combat Command (2); 1st Interceptor Command (2); 1st Bomber Command (2).

6. * 1AS D199E CONTACT REPORTS WILL BE SENT IN PRESCRIBED CODE ONLY PERIOD FOR THE PRESENT POSITION REPORTS NEED NOT BE ENCODED

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~~S E C R E T~~

c. Location, course and speed of the vessel and time of observation as prescribed for position reports.

d. Example: If an unidentified submarine was located at the position given above making a speed of 15 miles per hour on a course of 41 degrees at 2:15 P.M., the following report would be sent:

CR Unidentified submarine 032 (Lat) 522 (Long) 041 (Course) 015 (Speed) 1415 (Time)

6. * ~~For this procedure, no procedure will be executed.~~

By order of Colonel KEPNER:

JOHN P. DOYLE, JR.,
Major, Air Corps,
Executive.

OFFICIAL:

EDWARD J. CULLETON,
2nd Lt., Air Corps,
Adjutant.

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S E C R E T

1ST AIR SUPPORT COMMAND,
MITCHEL FIELD, NEW YORK,
18 December 1941

Annex No. 2

To Accompany Letter of Instructions No. 1

IDENTIFICATION OF FRIENDLY AIRCRAFT

December 11, 1941

1 AF D 267 G PERIOD LETTER ACC THREE TWO FOUR POINT FIVE AWS DECEMBER TENTH SUBJECT IDENTIFICATION OF FRIENDLY AIRCRAFT IS REPEATED FOR YOUR COMPLIANCE PERIOD THIS MESSAGE GOING TO ALL AIR BASE COMMANDERS AF ONE COMMA COMBOMCOM ONE COMMA COMINTERCOM ONE COMMA COBASCOM ONE AND COASCOM ONE COLON QUOTE PAR ONE ACTIVE AIR DEFENSE ZONES HAVE BEEN ESTABLISHED ALONG THE COASTAL FRONTIERS OF THE UNITED STATES PERIOD PAR TWO THE FOLLOWING PROCEDURE WILL BE INSTITUTED IMMEDIATELY TO ENABLE THE IDENTIFICATION OF FRIENDLY AIRCRAFT FLYING IN ANY PORTION OF THE ZONES WHOSE LIMITS ARE AS FOLLOWS COLON PAR A EAST COAST A ZONE EXTENDING FROM THE CANADIAN DASH U S BORDER TO SAVANNAH COMMA GEORGIA COMMA AND FROM THE SHORE LINE EXTENDING ONE HUNDRED FIFTY MILES INLAND AND TWO HUNDRED MILES SEAWARD PERIOD EXTENSION SOUTHWARD TO KEY WEST FLORIDA COMMA IS ANTICIPATED IN THE NEAR FUTURE PERIOD PAR B WEST COAST COMMA A ZONE EXTENDING FROM THE CANADA DASH U S BORDER TO THE MEXICO DASH U S BORDERS AND EXTENDING FROM THE SHORE LINE ONE HUNDRED FIFTY MILES INLAND AND TWO HUNDRED MILES SEAWARD PERIOD PAR C LOCAL EXTENSION OF THE REPORTING PROCEDURE OR OF ZONE BOUNDARIES PERTAINING TO THE ACTIVE AIR DEFENSE ZONE WITHIN EACH AIR FORCE AREA MAY BE PRESCRIBED BY THE INTERCEPTOR COMMANDER OF THAT AIR FORCE WHEN THE SITUATION REQUIRES SUCH ACTION PERIOD HE WILL ADVISE ALL CONCERNED OF ANY SUCH EXTENSION PERIOD PAR THREE IT IS ESSENTIAL THAT IN THE PRESCRIBED ZONES COMPLETE AND TIMELY INFORMATION BE AVAILABLE TO AIR CORPS INFORMATION CENTERS CONCERNING ALL FRIENDLY MILITARY COMMA NAVAL AND CIVIL AIRCRAFT IN

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SEVEN MESSAGES SHOULD BE ADDRESSED TO THE QUOTE AIR CORPS INFORMATION CENTER UNQUOTE AT ONE OF THE ADDRESSES GIVEN ABOVE PERIOD PAR EIGHT THE OPERATIONS OFFICE AT POINT OF DESTINATION WILL ALWAYS ADVISE THE NEAREST INFORMATION CENTER OF ANY FLIGHTS WHICH ARE AT A SUBSTANTIAL VARIANCE FROM THEIR FLIGHT PLANS PERIOD PAR NINE AIRCRAFT UNDER CONTROL OF THIS COMMAND WILL COMPLY WITH THIS DIRECTIVE AT ONCE PERIOD PAR TEN IT IS REQUESTED THAT IMMEDIATE STEPS BE TAKEN TO REQUIRE THAT ALL AIRCRAFT UNDER THE CONTROL OF THE CHIEF OF AIR CORPS COMMA NAVY DEPARTMENT AND CIVIL AERONAUTICS ADMINISTRATION COMPLY SIGNED DELOS C EMMONS COMMA LIEUTENANT GENERAL COMMA U S ARMY COMMA COMMANDING UNQUOTE SIGNED AGAF ONE

By order of Colonel KEPNER:

JOHN P. DOYLE, JR.,
Major, Air Corps,
Executive.

OFFICIAL:

EDWARD J. CULLETON,
2nd Lt., Air Corps,
Adjutant.

DISTRIBUTION: All Units, 1st ASC (2); First Army (2); First Army Anti-Aircraft Artillery Command (2); First Air Force (2); First Air Force Base Command (2); Air Force Combat Command (2); 1st Interceptor Command (2); 1st Bomber Command (2).

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C O N F I D E N T I A L

1st Air Support Command
MITCHEL FIELD, NEW YORK
31 DECEMBER 1941

LETTER OF INSTRUCTION)
)
No. 2)

Maps: Aviation Plotting Chart VP-102; USN H. O. No.1411 and 1412; AWS Grid Map, First Coast Artillery District; Regional and Sectional Aeronautical Charts.

1. In the interest of necessary secrecy, Contact Reports of Enemy, Suspected Enemy, Friendly or Unidentified Craft, will not be reported by radio in the clear under any circumstances.

2. Radio reports made will use the following code designations, utilizing the phonetic alphabet if transmission is by voice:

Battleships	BI	Transport	CD
Cruiser	CR	Tanker	DC
Destroyer	FG	Unknown type	UT
Carrier	AR	Aircraft	DE
Submarine	SF		

3. Reports will be in form as follows:

(a) Number.
(b) Type (per paragraph 2 above).
(c) AWS Grid Coordinates.
(d) Time (24 hour clock).
(e) Approximate speed (and altitude to nearest 1000, if aircraft).
(f) Estimated True Course to nearest ten (10) degrees.

4. Group commanders will establish and maintain liaison as necessary with Harbor Defense Command Posts, and will arrange for continuous radio contact between Harbor Defense Radio Stations and squadron stations. Reports sent Harbor Defense Command Posts by radio will use procedure published herein.

5. Previously issued instructions in conflict herewith are rescinded.

By order of Colonel KEPNER:

JOHN P. DOYLE, Jr.,
Major, Air Corps,
Executive.

OFFICIAL:

EDWARD J. CUDLETON,
2nd Lieut., Air Corps,
Adjutant.

DISTRIBUTION: All Units 2 ea.; 1st ASC (2); First Army (2); First Army Anti-Aircraft Artillery Command (2); First Air Force (2); First Air Force Base Command (2); Air Force Combat Command (2); 1st Interceptor Command (2); 1st Bomber Command (2).

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C O N F I D E N T I A L

Hq., 1st Air Support Command
MITCHEL FIELD, N. Y.
7 January 1942

CHANGE NO. 1 TO: LETTER OF INSTRUCTIONS NO. 2 - 31 December 1941.

- Paragraph 2 is rescinded and the following is substituted therefore:

2. Radio reports made will use the following code designations, utilizing the phonetic alphabet if transmission is by voice:

Battleships	HI	Transport	CD
Cruiser	GH	Tanker	BC
Destroyer	FG	Unknown Type	UT
Carrier	AB	Aircraft	DE
Submarine - On Surface			EF
Submarine - Submerged			[redacted]ZU

By order of Colonel KEPNER:

JOHN P. DOYLE, JR.
Major, Air Corps
Executive

OFFICIAL:

EDWARD J. COLLETON
2nd Lt., Air Corps
Adjutant

DISTRIBUTION: All Units 2 ea.; 1st ASC (2); First Army (2); First Army Anti-Aircraft Artillery Command (2); First Air Force (2); First Air Force Base Command (2); Air Force Combat Command (2); 1st Interceptor Command (2); 1st Bomber Command (2).

C O N F I D E N T I A L

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HEADQUARTERS, FIRST AIR SUPPORT COMMAND
MITCHEL FIELD, NEW YORK

MEMORANDUM:

DATE: 1/13/42

SUBJECT : Aircraft status report, of non-combat aircraft, by units of this command, as of 2000 this date.

TO : The Commanding General, First Air Force, Mitchel Field, New York.

OBSERVERS

A (UNIT)	B (LOCATION)	C (TYPE)	D (Total) (Assgd)	E (In Serv.)
Hq. Sqdn. 1st ASC.	Mitchel Field, NY	C-40A	2	2
Hq. Sqdn. 26th Obsn. Gp.	Hillsgrove, RI	O-46A	1	1
		O-47B	1	1
101st Obsn. Sqdn.	Camp Edwards, Mass	O-46A	2	2
		O-47A	2	2
		O-49	3	3
		O-49A	1	1
		O-52	3	2
	X	YO-57	1	1
	X	C-59	3	2
103rd Obsn. Sqdn.	Hillsgrove, RI	O-46A	3	3
		O-47B	1	1
	X	O-49	2	2
	X	YO-57	1	0

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A (UNIT)	B (LOCATION)	C (TYPE)	D (Total) (Assgd)	E (In Serv)
152nd Obsn. Sqdn.	Fort Devens, Mass	O-47A	2	2
		O-49	2	2
		O-52	7	5
	X	O-58A	2	1
Hq. Sqdn. 59th Obsn. Gp.	Fort Dix, N.J. X	C-45	1	1
104th Obsn. Sqdn.	Atlantic City, NJ	O-46A	6	4
		O-47A	2	1
		O-47B	1	0
	X	O-49	3	2
	X	YO-59	3	3
119th Obsn. Sqdn.	Newark, N.J.	O-47A	1	1
	X	O-49	3	0
		O-52	10	5
	X	YO-58	1	0
126th Obsn. Sqdn.	Fort Dix, N.J.	BC-1A	1	0
		O-46A	1	1
		O-47A	1	1
	X	O-49	3	2
	X	O-59	2	2

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A (UNIT)	B (LOCATION)	C (TYPE)	D (Total) (Assgd)	E (In Serv)
Hq. Sqdn. 65th Obsn. Gp.	Langley Field,Va.			
105th Obsn. Sqdn.	Langley Field,Va.	O-47B	1	1
		O-49	2	2
		O-49A	1	1
		O-52	10	10
		O-57	3	3
112th Obsn. Sqdn.	Dover, Del.	O-47A	5	5
		O-47B	3	3
		O-49	2	2
		O-57	2	2
		YO-57	3 1	1
		O-58A	3	3
121st Obsn. Sqdn.	Langley Field,Va.	AT-6	1	1
		O-38E	1	1
		O-47B	1	1
		O-49	3	3
		O-58A	3	3

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A (UNIT)	B (LOCATION)	C (TYPE)	D (Total) (Assgd)	E (In Serv)
3rd Obsn. Sqdn.	Langley Field, Va	B-10B	2	1
		O-47	6	4
		O-49	3	1
		O-52	2	1
Tow Target Detachment	Manchester, NH	B-10B	2	2
		O-58	2	2
		O-59	2	1
Tow Target Detachment	Mitchel Field, NY	B-10BM	1	1
		O-58A	4	3
Tow Target Detachment	Pope Field, NC	B-10BM	3	2
		PT-17	2	2
2nd Balloon Sqdn.	Fort Bragg, NC	C-6	2	1

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January 16, 1942.

DISPOSITION OF NAVAL SHORE-BASED AIRCRAFT IN THE EASTERN THEATER

Iceland	7	Patrol Planes
Argentia, N. F.	8	Patrol Planes
Squantum, Mass.	12	Small Seaplanes
Quonset, R. I.	6	Patrol Planes
New York, N. Y.	12	Small Patrol Planes
Quantico, Va.	7	Dive Bombers (Marine)
Norfolk, Va.	27	Patrol Planes
Banana River, Fla.	8	Patrol Planes
Bermuda	12	Small Seaplanes
San Juan, P. R.	12	Patrol Planes
St. Thomas	10	Miscellaneous, Non-combatant

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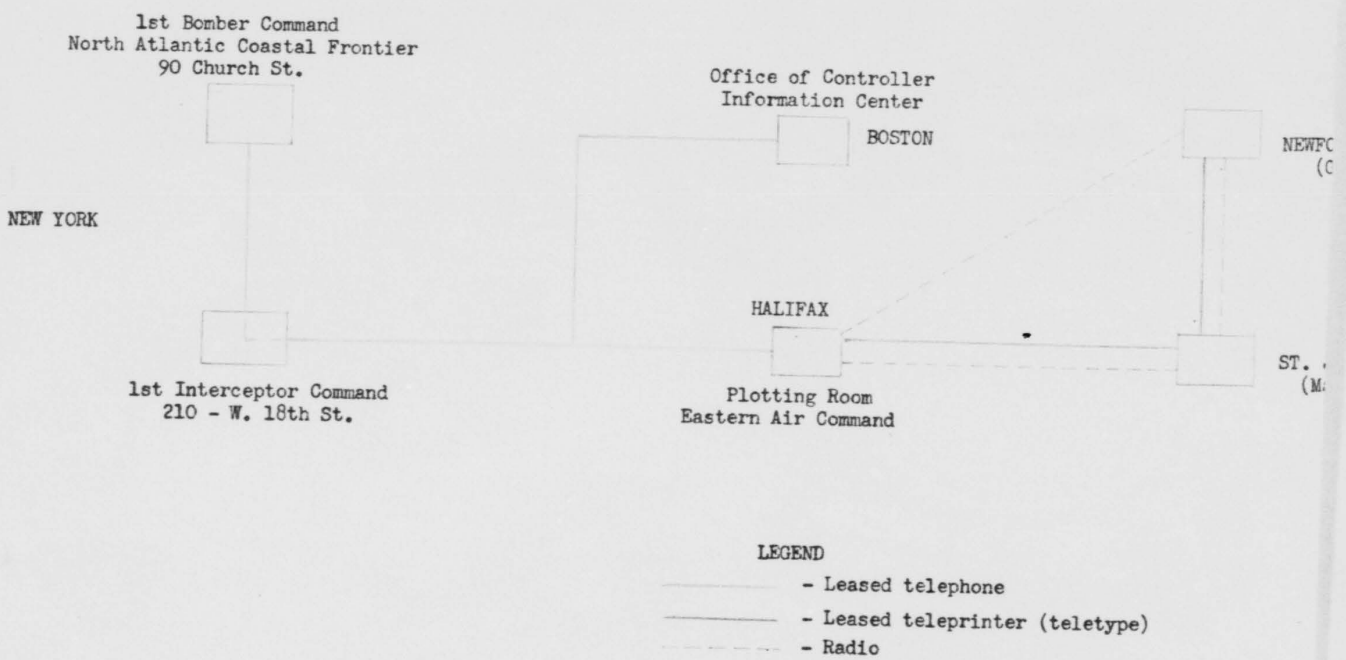
AIR FORCE COMMUNICATIONS, NEW YORK TO NEWFOUNDLAND



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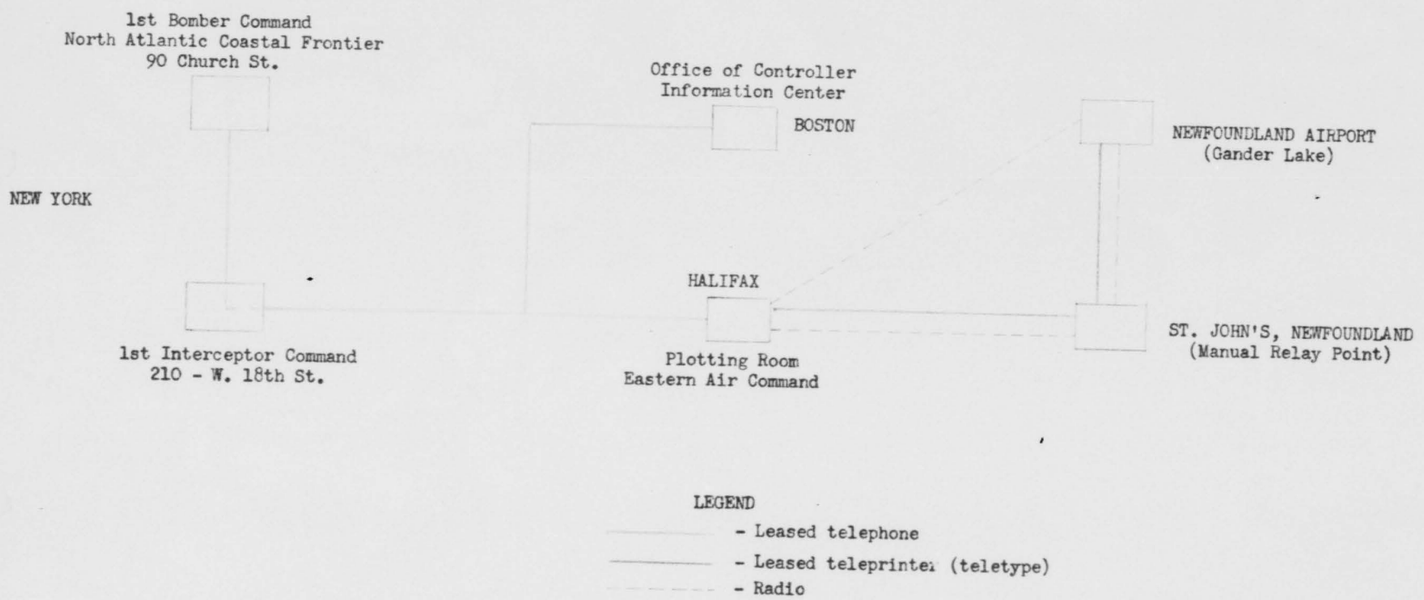
AIR FORCE COMMUNICATIONS, NEW YORK TO NEWFOUNDLAND



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IN REPLY REFER TO:

HEADQUARTERS
AIR FORCES, EASTERN THEATRE OF OPERATIONS
and
FIRST AIR FORCE
OFFICE OF THE AIR FORCE COMMANDER
MITCHEL FIELD, NEW YORK

Memo: Col Wooten

January 14, 1942

Resume' of Personnel - Signal Reporting Companies.

1. The following personnel is total in 1st Interceptor Command.

   a. Reporting platoons:

      2 officers (2 weeks practical experience)
      10 enlisted men (partially instructed, about 2 weeks experience)

   b. Plotting platoons:

      2 officers (partially trained)
      84 enlisted men (now manning information centers at Boston, New York, Philadelphia, Norfolk)

2. The following personnel is total reported by 3rd Interceptor Command.

   a. Reporting platoons:

      2 officers (practical experience)
      15 enlisted men (practical experience)

   b. Plotting platoons:

      None reported - Unknown

3. The following personnel assigned 1st & 3rd Interceptor Commands.

   3 officers (just graduated Fort Monmouth. No practical experience)

4. All other Signal personnel remaining under First Air Force control is entirely untrained for such operations. The only reservoir for officers and enlisted men available to complete companies is the 551st Signal Battalion Separate Aviation. It consists of overage National Guard Officers and recruits of 30 to 45 days total training none of whom have seen or had any experience with the type of equipment used.

H

A. T. LACEY,
Colonel, GSC,
G-1.

To be activated:
699th Sig Reporting Co, AWS.
700th Sig Reporting Co. AWS.
695th Sig Aircraft Warning Reporting Co.

TAB. "H"

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S E C R E T
Auth: CG, GHQ
Initials: E.H.
Date: 1-18-42

381-ETO-Avn
(1-15-42)

January 15, 1942.

SUBJECT: Preparation of Eastern Theater of Operations to Combat Hostile Surface and Sub-surface Activities.

TO: Deputy Chief of Staff for Air, Office of the Chief of Staff, War Department, Washington, D. C.

1. Reference your memorandum, above subject, January 14, 1942, this headquarters has investigated the plan of the Commander of the Eastern Theater of Operations for operations against hostile surface and sub-surface activities and the adequacy of this plan to meet this threat.

2. a. In general, the plan now in operation is to use all available means for reconnoitering the area to the east of the Atlantic coast line, between the northern tip of Maine and the Cape Hatteras, to the maximum range of bombardment and reconnaissance aircraft available to the Theater Commander. Bombardment airplanes carry bombs or depth charges for attacking submarines. This distant reconnaissance is supplemented by using all available observation aircraft for reconnoitering to a distance of approximately forty (40) miles from the shore. Interceptor aviation is maintained on alert for possible use against enemy air raids.

b. With respect to reconnaissance operations at sea, present equipment permits the performance of the following missions from the bases indicated:

Four (4) patrol missions daily from Bangor.
Eight (8) patrol missions daily from Westover.
Five (5) patrol missions from Mitchel Field.
Four (4) patrol missions daily from Langley Field.

c. In addition to the above, available equipment and personnel permits retaining a striking force available using personnel on rest periods at each base of approximately the following crews and airplanes:

Four (4) at Bangor.
Four (4) at Westover.
Three (3) at Mitchel Field.
Five (5) at Langley Field.

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3. Details of these plans and status of units are in Tabs A to F, herewith.

4. Close contact and coordination is maintained with the Navy at a Joint Information and Command Headquarters which has been established at 90 Church Street, New York City. All available information is sent to this joint information and control center, where the Bomber Command, the Commanding Officer of the North Atlantic Naval Coastal Frontier, and 3d Naval District, have established their Headquarters in conjunction with the Naval headquarters at that place. Decisions can be reached immediately, and instructions issued from this information and command center. This headquarters has direct telephone communication with the headquarters of the 1st Air Force, and through the 1st Interceptor Command with Halifax, Nova Scotia. Halifax, Nova Scotia, has direct teletype connection with St. John's, New Foundland; from which point TWX messages are relayed to the Newfoundland Airport. In addition, the 1st Air Force Headquarters has direct telephone communication with the Air Force Combat Command Headquarters at Bolling Field and with the 3d Air Force Headquarters at Tampa, Florida. This gives a complete direct and instantaneous communication between the interested defensive agencies in the Eastern area.

5. Joint Canadian and United States defense operations are covered in Joint Plan ABC-22, which was put into effect immediately upon the declaration of war. This plan provides for the coordination of military efforts between the United States and Canada by mutual cooperation and by assigning to the forces of each nation tasks for whose execution such forces shall be primarily responsible.

6. At the present time, close liaison and direct communication is maintained between the Commander of the Eastern Theater of Operations and the Canadian Eastern Air Commander.

7. Orders issued by The Adjutant General, December 30, 1941, file AG 320.2 (12-30-41)MC-M, subject: "Allocation of Army Aircraft Units and Associated Services and the Assignment of Air Bases and Airdromes", made a definite assignment of units to the Eastern Theater of Operations. This assignment withdrew a number of aviation units from that theater for other assignments, particularly to the Air Force Combat Command. This assignment left only three pursuit groups (less one squadron), two medium bombardment groups, one heavy bombardment group, and four observation groups in the Eastern Theater of Operations. Details of airplanes and combat crews strength of these units are shown on Tab. B.

8. The operations being undertaken and the location of units are shown on situation map, attached herewith, marked Tab. A.

9. The Navy is operating in this area in general as follows: Long-range patrol planes, operating directly under the Commander-in-Chief, Atlantic Fleet, are carrying out sweeps for the protection of the offshore sea lanes and convoys from bases in Iceland, Newfoundland, Rhode

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Island, and Virginia. These sweeps do not strictly constitute area patrols but are rather designed for the support of shipping. He also maintains a close patrol around Bermuda. In addition, daily and continuous close patrols are being maintained by the Commander of the North Atlantic Naval Coastal Frontier, operating from Boston, New York, and Norfolk; outside the Chesapeake Bay entrance to a radius of 100 miles (south of latitude 37) there is maintained a continuous patrol. Distribution by type is shown in Tab. F.

10. The total number of planes available to the Commander of the North Atlantic Naval Coastal Frontier for his exclusive use is twelve small seaplanes at Boston and twelve at New York. He is assisted or directly reinforced by about ten small planes at Cape May and about eighteen patrol planes at Norfolk, both attached to the Atlantic Fleet; the majority of which are, however, undergoing operational training. These latter are in addition to those in paragraph 9.

11. The Commander-in-Chief, Atlantic Fleet, has a general directive covering offensive action against enemy ships, and is continually given specific information as to enemy activities. This situation was considered in the organization of the Atlantic Fleet. The present enemy actions will result in intensive efforts on the part of both ships and aircraft, the details of which plans are not, at this writing, available in the Navy Department. The Commander-in-Chief, Atlantic Fleet, will undoubtedly employ all of his patrol planes in furtherance of his action. It is recognized that the forces are inadequate to cover completely the North Atlantic Seaboard. However, the forces available are located adjacent to focal points of shipping where the submarine menace can be considered the greatest. The Commander-in-Chief, Atlantic Fleet, is aware of the nature of Army off-shore patrols and can be expected to take these into consideration in his operations.

12. a. The best source of information available (Colonel Bissell) indicated that the Canadian Eastern Air Command is operating in the maritime provinces the following air units:

2 flying boat squadrons	— 14 planes
2 bomb-reconnaissance, land squadrons	— 24 planes
1 fighter squadron	— 15 P-40 type planes
3 coast artillery cooperative detachments	— 9 planes
1 general reconnaissance operational training unit	— 36 planes, consisting of 7 Ansons and 29 Hudsons.
1 general reconnaissance school	— 78 Ansons (2-engine planes)

The center of gravity for operations of planes in the maritime provinces is at Dartmouth, near Halifax. This is an excellent airport which has facilities for both land and seaplane operations. Additional fields are

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at DEBERTE, west of Halifax; NORTH SYDNEY, north of Halifax; and at YARMOUTH, at the southern tip of Nova Scotia.

b. In addition to the above, the Canadians are operating 16 medium bombardment land planes from Newfoundland.

13. Analysis of the present plan of operations for aviation units assigned to the Eastern Theater of Operations, in conjunction with the operations being conducted by the U. S. Navy and the Canadian Air Forces, indicates that the plans of the Commanding General, Eastern Theater of Operations, are sound, and that he is accomplishing all that can be reasonably expected with the airplanes and combat crews which have been made available to him. If possible, a reserve striking force should be formed as rapidly as possible. When additional aircraft and personnel are made available they should be used to form this reserve, rather than to unduly increase patrol service.

14. An analysis of the situation with reference to the United States Army Air Forces discloses that there is an acute shortage of airplanes, pilots, navigators, bombardiers, radio operators, armorers, and aircraft warning personnel throughout the entire theater. The weakness at the present time is a shortage of personnel and equipment, both in the Army and in the Navy. The operations of units are also being hampered by constant changes of personnel, by withdrawing Army cadres from operating units, by using tactical operations stations as staging points for moving personnel overseas, and for forming and training organizations which should be accomplished in the Zone of the Interior.

15. With respect to recommendations for whatever War Department action is required to enable this increased enemy threat to be met adequately, the following are submitted, subject to providing for more urgent requirements:

a. Immediate filling of air units assigned to Eastern Theater with airplanes of standard types, suitable for the tasks required.

b. Immediate furnishing of air force units in this theater with required combat personnel to operate aircraft assigned.

c. Immediate supply of spare parts required for maintenance of equipment.

d. Establish staging areas for overseas and other troop movements at other than Air Corps bases assigned to the Eastern Theater of Operations. The use of Mitchel Field as a staging point is interfering seriously with the tactical operations of that post.

e. Until units assigned to the Theater can be filled with airplanes and personnel, establish a minimum of one bombardment

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group on a training basis in the Northeast area, which will be available as a reserve on call from the Eastern Theater Commander for reinforcing this Theater, including Bermuda and Newfoundland.

f. Replace and supplement present observation planes assigned to observation units with A-20 type light bombardment planes which will be suitable also for attacking submarine targets and for operations at greater distances from the shore.

16. Report on the Western Defense Command operations plan will be forwarded as soon as received and analyzed.

For the COMMANDING GENERAL:

J. W. RAMSEY
Lt. Col., A.G.D.,
Asst.

8 Inclosures:
Tab. A - Situation Map
Tab. B - Airplane and Combat Crew Status, 1st AF
Tab. C - Report of Personnel & Equip, 1st Bomb Comd.
Tab. D - Report fr 1st Interceptor Comd.
Tab. E - Present Opns of 1st Air Sup Comd.
Tab. F - Naval Shore-Based Aircraft in ETO.
Tab. G - AF Communications, NY to Newfoundland.
Tab. H - Signal Reporting Companies, 1st AF.

JAN 16 1942
WAR DEPARTMENT
OFFICE OF CHIEF OF STAFF

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Occupation of Airfields in /12/
Brazil By AAF Units

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WAR DEPARTMENT
Headquarters Army A[illegible] Forces
Office Chief of the Air Staff
Washington, D. C.

Date _____

TO:
- Lt. Col. George
- Lt. Col. Craig
- Lt. Col. Walker ✓
- Lt. Col. Anderson
- Maj. Hansell
- Maj. Partridge
- Maj. Anderson
- Maj. Taylor
- Maj. Gillespie
- Maj. Fair
- Maj. Glantzborg
- Capt. Alling
- Capt. Oscanyan
- Capt. Harper
- Mr. McPherson

Please file in your safe

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A-W.P. DIVISION

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WAR DEPARTMENT
Headquarters Army Air Forces
Office Chief of the Air Staff
Washington, D. C.

Date 12/2

TO:

___Chief of the Army Air Forces
___C.G., Air Force Combat Command
___Chief of the Air Corps
___Chief of the Air Staff
___Secretary of the Air Staff
___A-1 Division
___A-2 Division
___A-3 Division
___A-4 Division
✓ Air War Plans Division
___Budget Section
___Public Relations
___Statistics Section
___Inspector, Army Air Forces
___Adjutant General, Army Air Forces
___A.F. Files

Note Sen. Isaacs instructions to hold until [illegible]

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RECEIVED
AIR WAR PLANS DIV.

VANAMAN,
Lt. Colonel, Air Corps,
Secretary, Air Staff.

AAF-63-B.

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WAR DEPARTMENT
Headquarters Army Air Forces
Office Chief of the Air Staff
Washington, D.C.

Date 11/27/41

TO: General Spaatz

Attached is an informal note from Capt. Sherman of the Navy to Col. Craig. There is little doubt that his note indicates the official Navy view. It seems that the Secretary of War must consider this to be a matter of extreme importance since he originally signed a letter to the Secretary of State, copy of which is attached hereto as Tab A.

In view of Capt. Sherman's note, and the restricted concurrence of General Gerow to our action paper to the Chief of Staff, what further action do you desire?

Hold until further

H. L. GEORGE,
Lt. Colonel, A.C.

A-W P DIVISION

X-225-E, A.C.

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WAR DEPARTMENT
Office of the Chief of the Army Air Forces
Washington

SYNOPSIS

MEMORANDUM FOR THE CHIEF OF STAFF:

Subject: Occupation of Air Fields in Brazil by Army Air Force Units.

I. Discussion.

1. Refers to letter of Secretary of War to Secretary of State dated August 30, 1941, concerning Brazilian situation. Dispatch of this letter was deferred at request of Chief of Naval Operations.

2. Quotes pertinent portion of above letter.

3. Cites early completion of Pan American Airways fields in Brazil and points out their vulnerability.

4. Indicates that ground and air forces should occupy northeast Brazil.

II. Action recommended.

That the letter of the Secretary of War referred to above be dispatched without further delay.

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In reply refer to Initials and No.

Op-12A-4-gj

NAVY DEPARTMENT
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
WASHINGTON

SECRET

November 24, 1941.

Memorandum for Lieutenant Colonel Craig.

Subject: Occupation of Airfields in Brazil by Army Air Force Units.

1. I have read the papers which you left with me Saturday morning, November 22. The following comments summarize the Navy attitude on this situation as I understand it:

(a) The Navy now has an extremely urgent need for the use of ports in Eastern Brazil for the operation of tender based seaplanes for the purpose of protecting shipping. The Brazilian Government has been reluctant to concede the necessary authority because of the Brazilian fear of anything resembling an American occupation.

(b) For the foregoing reason, the Navy earnestly requested the Army to desist from pressing Brazil for permission to establish any army forces in Brazil until after naval aircraft were actually established. It was understood that the Army had agreed to this procedure.

(c) The much needed authority for tender based seaplane operations was recently granted by the Brazilian Government. However, after the seaplane tenders were dispatched and evidently as the result of unofficial pressure from our Army officers in Brazil for authority to station Army units in Brazil, the Brazilians have become alarmed and opposition to the presence of any American aircraft has increased to such an extent that authority to base naval seaplanes in Brazilian ports has been withdrawn.

(d) The stationing of Army troops or aircraft in Brazil is not believed to be required now by the strategic situation.

(e) Since it is evident that continued efforts to station Army units in Brazil are preventing the

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Navy from conducting operations urgently needed for the protection of shipping in the adjacent sea areas, and are thereby hampering other efforts important to both the Army and the Navy, the project covered by the attached papers should not be supported at this time.

2. I am giving you this information by informal memorandum which is what I understand you wish. I believe that the project should be referred formally to the Navy Department before it goes any further.

Forrest Sherman.

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WAR DEPARTMENT
HEADQUARTERS ARMY AIR FORCES
DISPOSITION FORM

Date NOV 6 1941

AG

AAF/344

SUBJECT: Occupation of Air Fields in Brazil by Army Air Force Units.

	USW	ASW	ASWA	B-LP	BOWD	BPR
	C/S	G-1	G-2	G-3	G-4	X.WPD
	Sec.G/S	NGB	JAG	1G	QMG	SG
TO:	OCAC	CSO	Fin.	Ord.	Ex.R.A.	ENGR
	AFCC	Inf	FA	Cav	CAC	CWS
	TAG					

FOR:
SW directs
Draft of reply attached
Approved
Disapproved
File

X.Comment or concurrence
Direct reply made
Inviting attention to
See notation of _____
Information

Information for reply
_____Ind. approved
Primary interest
Noted and return to Air
Noted _____ Staff

For the Chief of the Army Air Forces:

CHARLES E. [illegible],
Lt. Col., Air Corps,
Secretary of The Air Staff.

Incl.
Memo for C/S, AAF/344, 11/6/41, abv subj., w/ cy ltr to Sec/State fm Sec/War 8/30/41.

NOV 6 4 41 PM

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WAR DEPARTMENT
HEADQUARTERS OF THE ARMY AIR FORCES
WASHINGTON

A.A.F./344 NOV 6 1941

MEMORANDUM FOR THE CHIEF OF STAFF:

Subject: Occupation of Air Fields in Brazil by Army Air Force Units.

I. Discussion.

1. Reference is made to a secret letter (Tab A) signed by the Secretary of War on August 30, 1941, addressed to the Secretary of State concerning the Brazilian situation with respect to military cooperation in Hemisphere Defense. The dispatch of this letter has been deferred at the request of the Chief of Naval Operations.

2. It appears that this communication was approved by the Office of the Chief of Staff prior to its submission to the Secretary of War. However, it is desired to quote from that letter:

"On June 13, 1941, the Secretary of the Navy and I transmitted by joint letter to the President a report of June 4, 1941, by the Joint Planning Committee of The Joint Army and Navy Board. That report stated the opinion of its Army and Navy authors that the military situation, as of that date, was such as to warrant obtaining immediately the consent of the Brazilian Government to the movement of United States Army and Navy security forces to northeast Brazil without awaiting an actual attack. The Chief of Naval Operations, the Chief of Staff, the Secretary of the Navy and I all subscribed to that view.

"The joint letter to the President, to which I refer, recommended that he authorize the Department of State, acting in collaboration with the War and Navy Departments, to initiate action to secure the consent of the Brazilian Government without delay.

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"I judge this matter to be among the most important questions of foreign policy now confronting this nation, and as such, one which you, Secretary Knox and I should present jointly to the President as soon as his convenience will permit."

3. Information lately received indicates that the airports being developed by Pan American Airways in northern Brazil are to be completed by February 1. These airports, although essentially commercial in character, would be suitable for military operations if additional installations for troops and equipment are provided. The Brazilian Government has expressed its intention to protect these potential air bases and construct the necessary installations with aid from the United States. However, the vulnerability of these installations, when considered in conjunction with the weekly landings of Lati planes at Natal and Recife from Europe, the existence of hostile elements in Brazil, and the inadequacy of Brazilian troops stationed in northeast Brazil, indicate the desirability of protecting these points with our own troops.

4. Under the existing basis of agreement between the United States and Brazil, authority for stationing United States troops in Brazil does not exist unless "specifically requested" by the Brazilian Government. The definite attitude of the Brazilian Government at present is one of opposition to the stationing of any United States troops in that country. A Board of Army Officers has recently returned from Brazil and is now preparing a war plan for the occupation and defense of northeast Brazil. This plan contemplates a defense designed around an Air Force ground and air organization protected by at least one triangular division of United States troops. The Chief of the Army Air Forces is fully in accord with this general plan and recommends that an air force be stationed in northeast Brazil in January 1942, or as soon thereafter as units may become available. This initial air force should consist of the following major elements:

1 group of heavy bombardment
1 group of medium bombardment
1 pursuit group
1 transport group
1 observation squadron
2 reconnaissance squadrons

With the necessary service and base troops, the total in the air component should be approximately ten thousand (10,000) officers and men and two hundred twenty-six (226) airplanes. This air force should be preceded by the ground troops considered necessary for the protection of the air bases.

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II. Action recommended.

That the letter of the Secretary of War, referred to herein, be dispatched without further delay.

III. Concurrences.

A. C. of S., WPD (L.T.S.), subject to withdrawal by Admiral Stark of his objection which it is recommended he be orally requested to do.

1 Incl.-
Cy ltr. to Sec/State
fr. Sec/War 8/30/41

Carl Spaatz
CARL SPAATZ
Brig. General, Air Corps,
Chief of The Air Staff.

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Tab A

WPD 4516-20

August 30, 1941

The Honorable,

The Secretary of State.

Dear Mr. Secretary:

There is a progressive deterioration in the Brazilian situation, with respect to military cooperation in hemisphere defense.

The facts on which this statement is based and the action it is recommended that this Government take are stated below.

On June 13, 1941, the Secretary of the Navy and I transmitted by joint letter to the President a report of June 4, 1941, by the Joint Planning Committee of The Joint Army and Navy Board. That report stated the opinion of its Army and Navy authors that the military situation, as of that date, was such as to warrant obtaining immediately the consent of the Brazilian Government to the movement of United States Army and Navy security forces to northeast Brazil without awaiting an actual attack. The Chief of Naval Operations, the Chief of Staff, the Secretary of the Navy and I all subscribed to that view.

The joint letter to the President, to which I refer, recommended that he authorize the Department of State, acting in collaboration with the War and Navy Departments, to initiate action to secure the consent of the Brazilian Government without delay.

The War Department on June 5, 1941, forwarded a copy of The Joint Planning Committee report to the Under Secretary of State for his own confidential and advance information, informing him by accompanying memorandum that approval of this report by the Joint Board was anticipated within the Next one or two days following, and that upon approval, The Joint Board would recommend to the Secretary of War and to the Secretary of the Navy that they approve and transmit it to the President for his action. A copy of this Joint Planning Committee report and of the joint letter transmitting it to the President are attached, marked Inclosures 1 and 2, respectively.

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On June 10, 1941, there was a discussion of this subject between the Under Secretary of State, the Chief of Naval Operations and the Chief of Staff, during which the Under Secretary of State requested a memorandum setting forth just what the War Department desired in northeast Brazil, and indicating that the Department of State would transmit these desires to our Ambassador to Brazil with instructions to present them in person to President Vargas, and request that Brazil accede to them.

The request of the Under Secretary of State was complied with in a memorandum furnished him on June 17, 1941, signed by the Chief of Staff, the Chief of Naval Operations concurring in the opinions therein expressed. A copy of this memorandum is attached and marked Inclosure No. 3.

The President on June 19, 1941, discussed this matter with the Secretary of War and the Chief of Staff. They presented to him the Joint Planning Committee report (Inclosure No. 1) and the memorandum of June 17, to the Under Secretary of State from the Chief of Staff (Inclosure No.3), through which the President glanced. The President discussed several possibilities. He seemed to think that the method most likely to succeed would be to induce President Vargas to give us a limited lease -- only for the period of the emergency -- to establish a small air base in the NATAL-RECIFE region. He seemed to think that this would be the only practicable basis upon which President Vargas could successfully accomplish this. The President indicated he wished the offer to come from Brazil.

Having been informed in May by the Chief of the United States Military Mission in Brazil that the Brazilian Army contemplated large scale maneuvers in the NATAL RECIFE region beginning in mid-August of this year, it appeared that this might offer an opportunity whereby Brazil could gracefully permit the entry of our security forces into that area, announcing publicly that in the spirit of the Havana Conventions, Brazil had invited the United States to participate in these maneuvers in order to work out on the ground defensive measures for that highly important portion of this hemisphere. (This point is well covered in Inclosure No. 3 herewith.) Instructions were sent to the Chief of the United States Military Mission in Brazil to discuss this matter with the Ambassador and subject to his counsel, to discuss it with the Brazilian military authorities. This has been done. In fact, the Ambassador himself has discussed it with the Brazilian Foreign Minister.

Ambassador Caffery reports the Foreign Minister as concurring with the Chief of Staff of the Brazilian Army in the

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following statement: "No matter how friendly it might be, no Government of Brazil could consent to this proposal and survive, unless the people of Brazil felt, as they do not now feel, that there was an actual threat to the integrity of Brazil."

Our Ambassador further reports substantially as follows:

I must say again that even though we will be asked by the Brazilians to send troops to northeast Brazil when the German menace seems imminent to them, I believe that unless we send to them supplies of material necessary for defending that area, they will not sooner ask us to send troops.

The Chief of the United States Military Mission reports:

"Ambassador Caffery discussed the matter with Mr. Aranha, who literally threw up his hands in consternation. As far as I know, the matter went no farther with the Brazilian Government."

He adds:

"It is believed that the project to participate in their maneuvers should be suspended."

The reports from which these statements are quoted were submitted with the knowledge and approval of our Ambassador.

From these developments as outlined above, two conclusions take form.

First, there has been for many months, persistent reiteration by Brazil that we seek to send troops but not to supply munitions. So often has this statement been made that it implies the existence of a settled policy to continue to apply the utmost pressure to us to supply their needs. Their argument is that the United States cannot on one hand emphasize the urgency of sending its forces to northeast Brazil and on the other hand defend its failure to release equipment to the Brazilian forces so that they may defend that region.

If candid, this statement reveals a seriously distorted view. The sincerity of our intentions to supply Brazil with munitions has been given material and frequent proof. We have sold them at gift prices all of the surplus coast defense material which we had on hand and which they desired. We have given them an Ordnance

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expert to assist them in every possible way to put this material to use, a form of assistance of incalculable benefit to Brazil and one which this Government has accorded to no other American Republic. We have permitted them to procure 30 North American training airplanes of modern type. We have sent, on our own initiative, three new Ryan training airplanes to our Mission in Brazil for the sole purpose of making them available to the Brazilian Army Air Forces. We have recently shipped light tanks, scout cars and automotive vehicles, which were diverted from our own urgent use in violation of established priorities, for the sole purpose of evidencing the sincerity of our intentions toward the Brazilian Government.

We do not have, and for a considerable period, we will not have, munitions to supply to Brazil of the types Brazil desires. The requirements of our own forces, of the British, and of other Governments actively engaged in resisting aggression take precedence over the needs of Brazil. These decisions have been reached by superior agencies of our Government in the light of our own national interests and the world situation. We do not propose to change them.

That is the first point.

The Second point refers to our Ambassador's statement in reporting that no Brazilian Government could consent to the entry of our forces and survive, unless the people of Brazil felt, as he states they do not now feel, that there was an actual threat to Brazil's integrity. There is no evidence to indicate that the Brazilian Government is making any effort to reveal to its people the existence of the real and growing theat which menaces alike their country and ours, nor to enlighten it in such a way that it might support its President were he to invite our entry.

Permit me to summarize. For a year and a half, we have exerted our most earnest efforts to extend to Brazil the fullest measure of cooperation which our own critical needs would permit. We have given Brazil the most conclusive evidences of the sincerity of our intentions to increase this cooperation as our growing strength will allow. These evidences have been expressed both materially, and through the official utterances of our highest authorities. In spite of all this, we are still today no closer to the attainment of what the War and Navy Departments are convinced is our most vital need with respect to Brazil, namely, the occupation by our security forces of suitable bases in the NATAL-RECIFE region, by which means alone we can guarantee the security of that area against Axis infiltration or control. We are, in fact, in potentially greater danger through the mere passage of time, as well as through growing Axis activities in Brazil.

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These considerations impel me to suggest that the time has arrived when the Brazilian Government should be informed of these facts, and told in unequivocal terms what we will do and what we will not do. I further suggest that the time has arrived when this Government in the most formal manner should bring to the attention of the Brazilian Government the high importance to Brazil, to the United States, and to this entire Hemisphere, of preventing any Axis infiltration into or control of the northeast portion of Brazil and to insist that Brazil comply with the request of this Government for the entry of our security forces into her strategic northeast for the period of the emergency, a request which we deem it imperative to make in the interests of our joint safety.

I judge this matter to be among the most important questions of foreign policy now confronting this nation, and as such, one which you, Secretary Knox and I should present jointly to the President as soon as his convenience will permit.

I should appreciate an expression of your views.

Sincerely yours,

Secretary of War.

3 Incls.
1 - Rept. of Jt. Plng. Comte, 6/4/41
2 - Memo for U Sec State, 6/17/41
3 - Ltr to Pres, 6/13/41

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SUBJECT: Occupation of Air Fields in Brazil by Army Air Force Units.

Received from the Chief of the Army Air Forces, memorandum for the Chief of Staff, above subject, dated NOV 6 1944 with Cy. ltr. to Sec/State fr. Sec/War. 8/30/41.

Officer Rank

Note; To be accomplished and returned to the Air Adj. Gen.

Office

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Syopsis of Annex 17 to GHQ
Operation Plan NE Brazil Cy #2

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ANNEX 17
AIR DEFENSE PLAN
TO
OPERATIONS PLAN
NE BRAZIL THEATRE

SYNOPSIS

GENERAL

The Air Defense of Recife, Natal, and Fernando De Noronha areas will be organized into an Interceptor Command.

The Air Defense of the Belem and Bahia areas will be organized as independent Air Defense Areas.

The Theatre Air Force Commander under direction of the Theatre Commander will be responsible for the coordination of means and measures for Air Defense of the Theatre, including the organization and operation of the Interceptor Command.

The Commanders of the Belem and Bahia sectors will be responsible for the Air Defense of their respective sectors. Plans for the Air Defense of these sectors will be submitted to the Theatre Commander for approval.

INTERCEPTOR COMMAND

Commander - The Theatre Air Force Commander, in addition to his other duties, commands the Theatre Interceptor Command.

Organization - Interceptor Command is composed of all Pursuit, AWS, AA Artillery and Barrage Balloons assigned or attached.

Regional information centers to be established at Natal and Recife.

Locations to be provided at Fernando De Noronha for two long range detectors to report direct to Natal.

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PURSUIT AVIATION

Natal - 1 Pur Gp (I) (less 1 sq)

Recife - 1 Pur Sq. (I)

Belem - 1 Pur Sq (I)

AIRCRAFT WARNING SERVICE

Component elements
Facilities
Operations
Location of elements
Command Posts

See Section VI
Annex 13 and
Section III Annex 14

ANTI -AIRCRAFT ARTILLERY

Mission - To provide anti-aircraft protection for NE Brazil Theatre, with particular attention to air bases and important seaports.

Organization - Assigned to sectors and sub-sectors as shown in Annex 2 Distribution of Forces.

The AA artillery troops at Natal and Recife are attached to the Interceptor Command. Local AA defense plans therein will be coordinated with the respective sector commanders.

AA Artillery areas will be prescribed for each area covered by AA Artillery. Aircraft activity in such areas will be limited to controlled take-offs and landings and to such pursuit combat as is directed by the Interceptor Commander. The Theatre Interceptor Commander will effect the necessary coordination with Sector Commanders and all elements concerned, to include

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warnings to AA Artillery of friendly air approach and orders to withhold fire, and the prescription of recognition signals to be given by aircraft.

The Theatre Air Force Commander will provide cooperative training missions for all AA Artillery.

Barrage Balloons - No data.

MISCELLANEOUS

Air Raid Warnings - The Interceptor Commander is responsible for notifying military, naval, and civilian agencies as directed by Theatre Commander.

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Jan 1942

TO THE ARCHIVES
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HISTORICAL OFFICE

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STRATEGIC IMPORTANCE
of
NORTHEAST BRAZIL

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WAR DEPARTMENT
OFFICE OF THE CHIEF OF THE ARMY AIR FORCES
WASHINGTON January [illegible], 1942

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DoD Dir 5200.9, 27 Sep
Do Dr, ESI - Ini
JUN 1960
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MEMORANDUM FOR THE CHIEF OF THE AIR STAFF:

Subject: Strategic importance of Northeast Brazil.

I. Discussion.

1. In discussing the strategic importance of northeast Brazil, it is first necessary to examine its geographic position while bearing in mind the capabilities of long range aircraft.

a. See Map. Northeast Brazil extends eastward so that the distance from Africa to the Western Hemisphere is only 1600 nautical miles. This short distance, coupled with the generally favorable flying weather in this vicinity, has permitted establishment of regular air lines across the South Atlantic. Germany, Italy, and France have all operated aircraft across this stretch of ocean and until recently, Lati, an Italian company, has flown land planes regularly from the Cape Verde Islands to Natal and Recife.

b. The fact that Brazil juts into the Atlantic allows aircraft based at fields in the northeast "bulge" to patrol wide areas of the ocean and control shipping by air power. A nation having air bases in the vicinity of Dakar or the Cape Verde Islands, as well as in northeast Brazil, can control practically all ocean shipping in the Atlantic enroute from South America to Europe or to North or Central America and from southern Africa to the same destinations. Thus control of the narrow strip of water between northeast Brazil and Western Africa assumes great importance from a military as well as economic viewpoint.

c. Germany has several types of airplanes of ranges which permit operation across the Dakar-Natal airway. Three known types are listed and their range (not radius) has been indicated on the map by arcs centered on Dakar.

Type	Range
He 111-K	2140 Statute Miles
Focke Wolf Kurier	3000 " "
He 177	3400 " "

From a base in the Cape Verde Islands, the He 177 could reach an arc

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which includes Maracaibo, Venezuela. From a base in the Azores, the same airplane could reach a strip along the northeastern coast of Brazil. Germany is also known to have a large 4-engined transport (the Ju-90) which carries a load of 15,000 pounds but its range is not known.

2. The importance of the Dakar-Natal link in the world's airways is well illustrated by recent airport developments.

a. The Army Air Forces, through contract with Pan American Airways, has developed airfields along the coast from Trinidad to Bahia as well as along a cut-off from Belem to Rio de Janeiro. The airports along the coast, starting at Trinidad, are -- (see map)

1. Georgetown, British Guiana
2. Paramaribo, Surinam
3. Cayenne, French Guiana
4. Amapa, Brazil
5. Belem, Brazil
6. Sao Luiz, Brazil
7. Fortaleza, Brazil
8. Natal, Brazil
9. Recife, Brazil
10. Maceio, Brazil
11. Bahia, Brazil

b. In Africa there are about 145 airports of various sizes on the mainland within 750 miles of Dakar. These do not include any fields on the Cape Verde Islands.

3. The United States and associated powers must prevent the Axis from seizing northeast Brazil and must retain control of this vital area:

a. Loss of control would jeopardize the Panama Canal. That installation can be attacked from the air by any country having bases within the circle shown on the map.

b. Loss of control would cut our easterly air ferry route to the Middle and Far East. This route now follows the blue line on the map and will eventually pass through a depot at Gura, Eritrea.

c. Loss of control would make most difficult any shipping through the Dakar-Natal area. These shipping lanes are of the utmost importance at the present time since supplies to the Middle East as well as to India and the Far East pass around the Cape of Good Hope from Atlantic Ports.

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WAR DEPARTMENT
OFFICE OF THE CHIEF OF THE ARMY AIR FORCES
WASHINGTON January [illegible] 1942

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DoD Dir 5200.9, 27 Sep [illegible]
OSD Dir, ESA – Ini
JUN 1960
11-18-571

MEMORANDUM FOR THE CHIEF OF THE AIR STAFF:

Subject: Strategic importance of Northeast Brazil.

I. Discussion.

1. In discussing the strategic importance of northeast Brazil, it is first necessary to examine its geographic position while bearing in mind the capabilities of long range aircraft.

a. See Map. Northeast Brazil extends eastward so that the distance from Africa to the Western Hemisphere is only 1600 nautical miles. This short distance, coupled with the generally favorable flying weather in this vicinity, has permitted establishment of regular air lines across the South Atlantic. Germany, Italy, and France have all operated aircraft across this stretch of ocean and until recently, Lati, an Italian company, has flown land planes regularly from the Cape Verde Islands to Natal and Recife.

b. The fact that Brazil juts into the Atlantic allows aircraft based at fields in the northeast "bulge" to patrol wide areas of the ocean and control shipping by air power. A nation having air bases in the vicinity of Dakar or the Cape Verde Islands, as well as in northeast Brazil, can control practically all ocean shipping in the Atlantic enroute from South America to Europe or to North or Central America and from southern Africa to the same destinations. Thus control of the narrow strip of water between northeast Brazil and Western Africa assumes great importance from a military as well as economic viewpoint.

c. Germany has several types of airplanes of ranges which permit operation across the Dakar-Natal airway. Three known types are listed and their range (not radius) has been indicated on the map by arcs centered on Dakar.

Type	Range
He 111-K	2140 Statute Miles
Focke Wolf Kurier	3000 " "
He 177	3400 " "

From a base in the Cape Verde Islands, the He 177 could reach an arc

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CHEMICAL WARFARE SERVICE
MUNITIONS BOARD

CWS Unit
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d. Loss of control would cut off our supplies from eastern South America immediately.

e. Loss of control will probably mean loss of cooperation of South American countries. If Brazil falls to the Axis, the remainder of the South American countries may be forced to follow.

4. The seizure of Brazil by Axis forces is a comparatively simple matter.

a. Control of the airports is the key. There is no other means of intercommunication laterally along the coast, except by sea. The airports are undefended and could be seized by a handful of good troops at each place. This would be especially easy with Fifth Column assistance. There were 2,000,000 Italian, 200,000 German, and 200,000 Japanese immigrants to Brazil up to about 1930. While these settlers west mostly to the southeast, it is known that the Germans have been active in organizing in the northeast and that both German and Italian aviation personnel are thoroughly acquainted with the country and its facilities.

b. Once the Axis powers control the key airports, it will be very difficult to remove their troops.

c. At the present time, the ABCD powers are powerless to prevent the Axis from flying troops into Brazil and seizing the airports. Brazil has no army suitable to the task and through subversive action might even assist the Axis.

II. Action Recommended. FOR OFFICIAL USE ONLY (AFR 190-16)

That Brazil "invite" the United States to safeguard its airports and occupy them by airborne troops immediately. If there is no "invitation," seize them at once and in force.

FOR OFFICIAL USE ONLY (AFR 190-16)

H.L.G.
C/AWPD

Incl.
Map

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180
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BEAUFORT SEA
MELVILLE ISLAND
BANKS ISLAND
VICTORIA ISLAND
AMUNDSEN GULF
PR. ALBERT PENS.
BOOTHIA PENS.
MELVILLE SOUND
M'CLINTOCK CHANNEL
M'CLURE STRAIT
PR. PATRICK I.
BROCK I.
BORDEN I.
LOUGHEED I.
FINDLAY Is.
BATHURST I.
DEVON I.
SOMERSET ISLAND
PRINCE OF WALES I.
BARING LAND
Herald I.
Pt Barrow
Icy C.
Takpuk I.
C Lisburne
C Thompson
C Dezhneva
C Pr of Wales
Kotzebue Sd
BERING STRAIT
ALASKA
GULF OF ANADIR
C Nome
NORTON SOUND
St Lawrence I.
St Michael
Navarin
Yukon R.
Ft Yukon
Nelson
Nunivak I.
St Matthew I.
Kuskokwim R.
Bristol Bay
Pribilof Is
Unimak
Unalaska
Andreanof Is
ALEUTIAN ISLANDS
Kotzebue
Kobuk R.
Selawik L.
Selawik
Noatak R.
Kotzebue Sd
Kobuk
Alatna R.
Koyukuk R.
Yukon R.
Nulato
Kaltag
Unalakleet
Norton Bay
Shaktoolik
Golovin
White Mts
Yukon Flats
Tanana R.
Fairbanks
Tanana
Rampart
Ruby
Kuskokwim Mts
Kuskokwim R.
McGrath
Takotna
Ophir
Iditarod
Flat
Holy Cross
Anvik
Anvik R.
Innoko R.
Shageluk
Yukon R.
Russian Mission
Marshall
Pilot Station
Kuskokwim Bay
Nunivak I.
Mekoryuk
Hooper Bay
Chevak
Scammon Bay
Kotlik
Alakanuk
Emmonak
St Michael
Stuart I.
Bering Sea
Nunivak I.
St Matthew I.
Pribilof Is
St Paul Hbr
Unimak
Unalaska
Andreanof Is
ALEUTIAN ISLANDS
GULF OF ALASKA
Yakutat
Yakutat Bay
Malaspina Glacier
Icy Bay
Valdez
Prince William Sd
Cordova
Kayak I.
Seward
Kenai Pen.
Kenai
Kodiak I.
Kodiak
Afognak I.
Shelikof Str
Alaska Pen.
Katmai
Naknek
Bristol Bay
Dillingham
Nushagak R.
Nushagak Bay
Togiak
Togiak Bay
Kuskokwim R.

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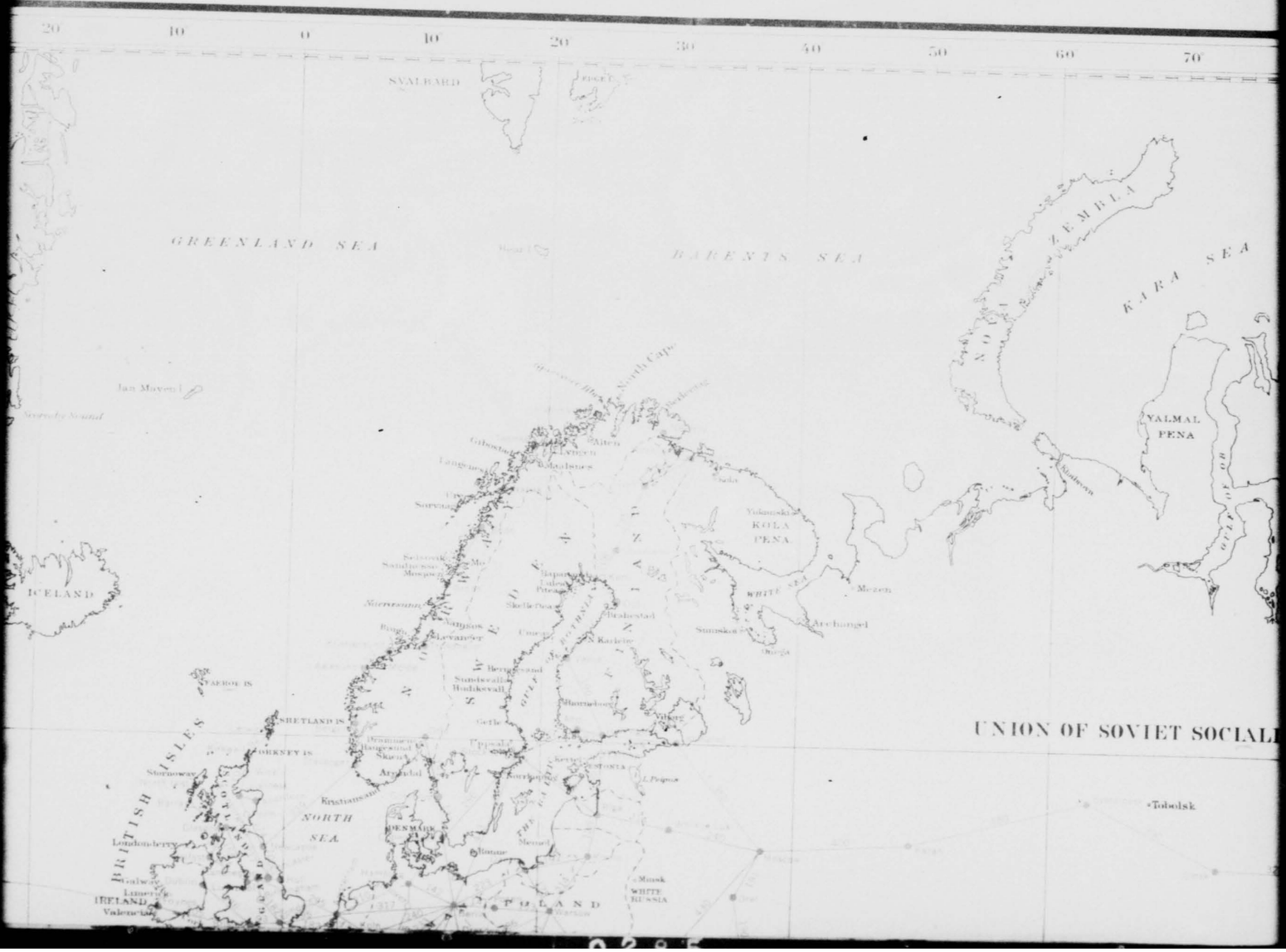

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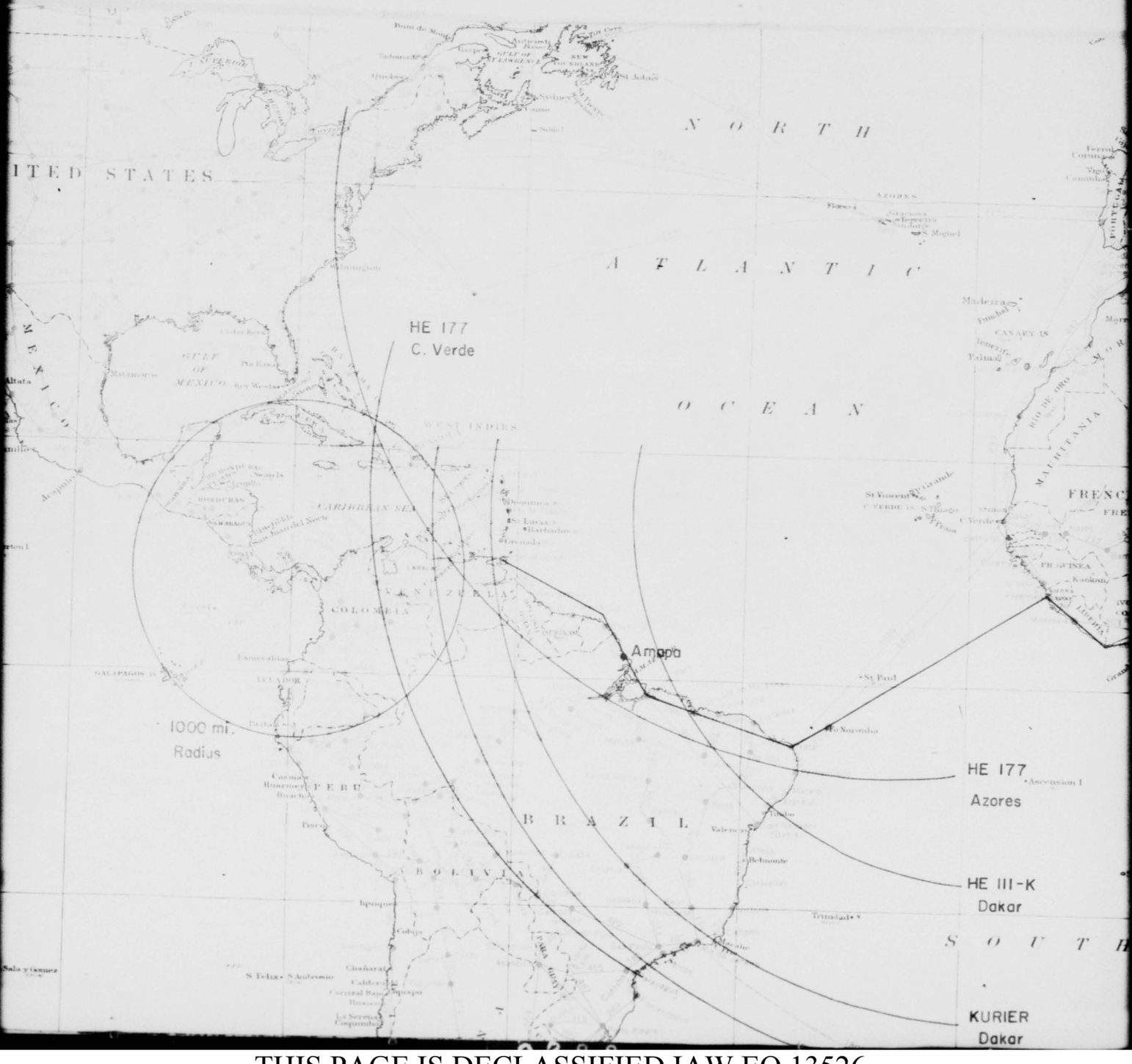

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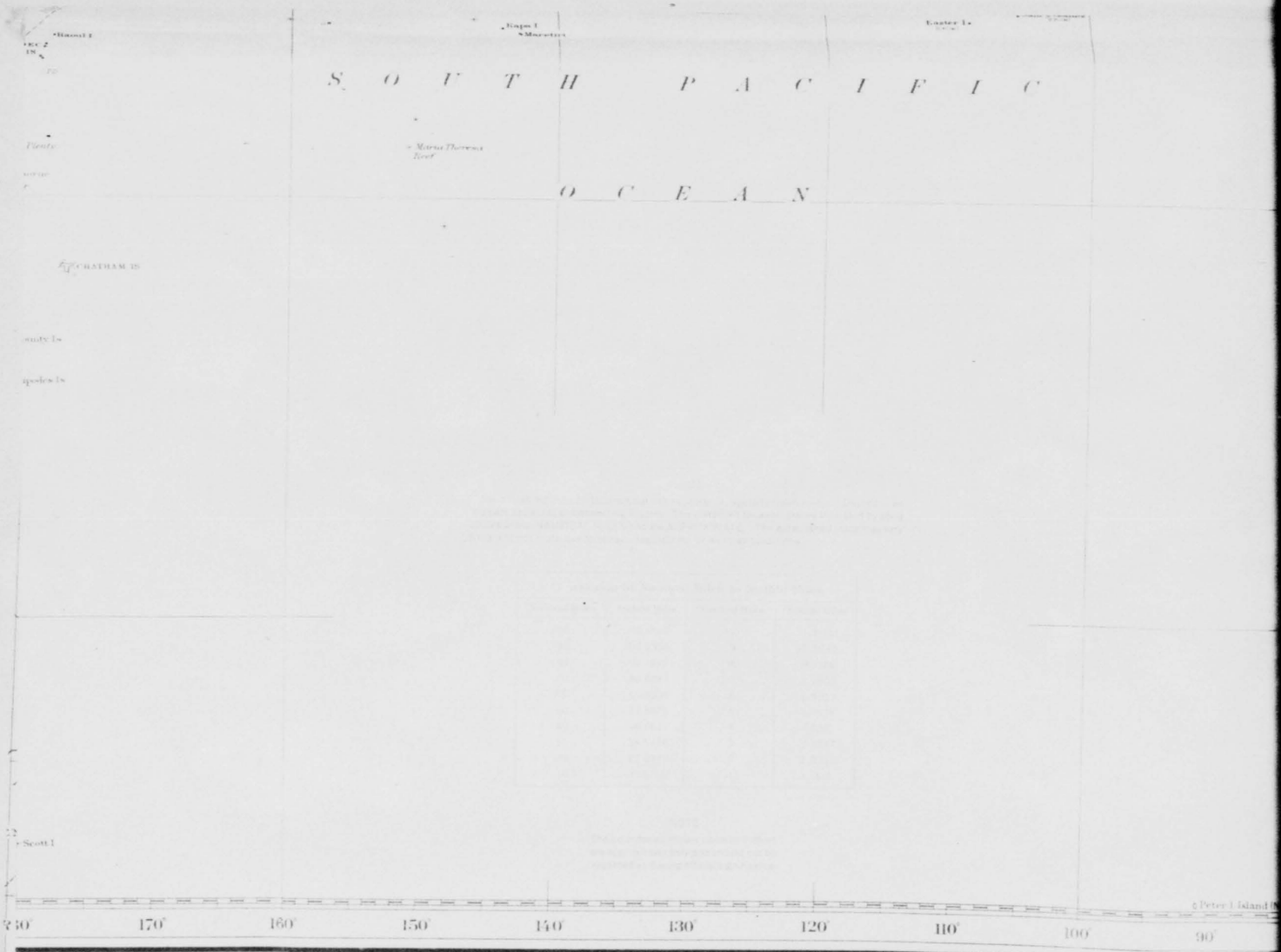

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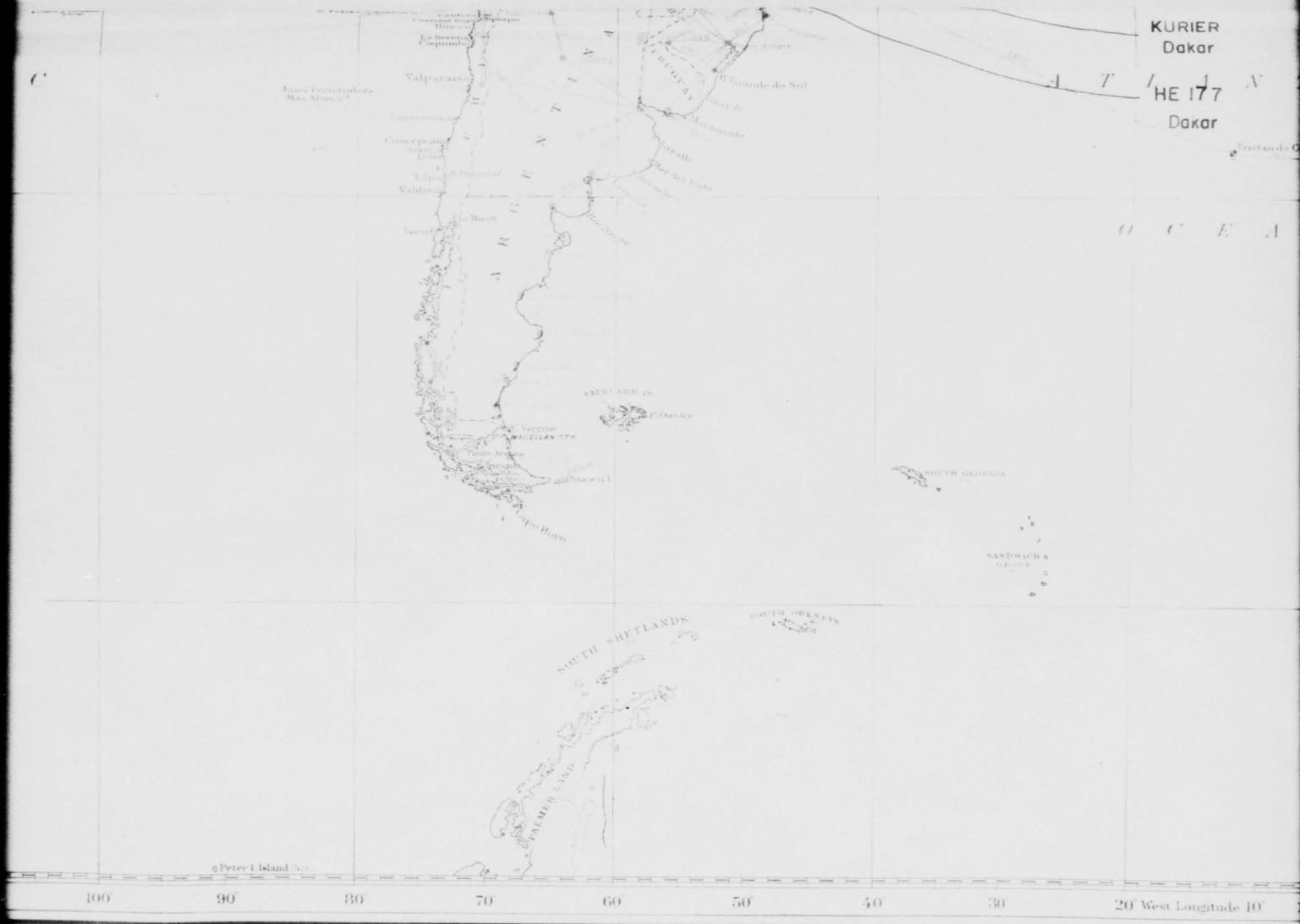

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Organization of Air Task Forde
EIGHTH A/F Mobile Reserve /23/

FILE No.
145.81-12
2 Jan 1942
TO THE 8TH AF
OR THE AAF
PICTORIAL OFFICER

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WAR DEPARTMENT
HEADQUARTERS OF THE ARMY AIR FORCES
WASHINGTON

JAN 2 - 1942

MEMORANDUM FOR THE COMMANDING GENERAL, AIR FORCE COMBAT COMMAND:
CHIEF OF THE AIR CORPS:
CHIEF OF STAFF, GHQ:
ASSISTANT CHIEF OF THE AIR STAFF, A-1:
ASSISTANT CHIEF OF THE AIR STAFF, A-2:
ASSISTANT CHIEF OF THE AIR STAFF, A-3:
ASSISTANT CHIEF OF THE AIR STAFF, A-4:
ASSISTANT CHIEF OF THE AIR STAFF, A-MPD:
COLONEL A. N. DUNCAN:

Subject: Organization of Air Task Force (To be designated the Fifth Air Force) for Mobile Reserve Corps.

1. Operations contemplated. Per instructions of Mobile Reserve Corps Commander.

2. The Fifth Air Force is a component of the Mobile Reserve Corps.

3. The Fifth Air Force will be assembled, organized and prepared for immediate operations at the earliest possible date. The Fifth Air Force is assigned to the Air Force Combat Command for training and preparation.

4. Basic factors affecting organization. In organizing, training and equipping the Fifth Air Force, consideration will be given to the following factors:

a. Possible location of units in two widely separated air base areas.

b. Airdromes within air base areas may be separated by water or by poor, if not impassable, road systems with no rail transportation.

c. No third echelon maintenance depots will be within the probable Theater of Operations.

d. The initial supply level should be set at ninety days supply.

e. Supply requirements will be needed to maintain a sixty day reserve.

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f. There will be not less than one division of ground troops in each air base area.

g. All elements except the medium bombers may be transported by surface vessels.

5. Composition. The Fifth Air Force will be composed as follows:

a. Air Force Headquarters.

b. Bomber Command - (Headquarters & Headquarters Squadron, Bomber Command.
(One Medium Bombardment Group.
(One Light Bombardment Group.

c. An Interceptor Command - (Headquarters & Headquarters Squadron, Interceptor Command.
(Two Interceptor Pursuit Groups, each with an Interceptor Control Squadron.
(The necessary Aircraft Warning Services.

d. One Group of Observation Aviation, with one Photo (Recon) Squadron.

e. A Service Command comprising adequate Air Base facilities and one Mobile Depot, with a Headquarters.

f. Engineer troops for the construction of base facilities.

g. Other auxiliary services.

A detailed list of forces required is attached as Tab A.

6. Command. Colonel A. M. Duncan is designated Commander of the ~~Fifth~~ Air Force and is responsible for the training of his organization, under the supervision of the Commanding General, Air Force Combat Command, to meet the requirements outlined above. He will submit any desired changes in the ~~accompanying~~ troop and equipment list ~~(Tab A)~~ to the Chief of the Army Air Forces.

7. All staff sections of the Air Staff and the Air Force Combat Command, and the Office, Chief of the Air Corps, will cooperate to the fullest with Colonel Duncan in preparing his forces for the proposed operations. Those agencies will prepare at once and submit to the Chief of the Air Staff detailed lists of personnel and equipment, both Air Corps and other arms, required for the Fifth Air Force. Tab A will be used as a general guide.

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8. Control of the Fifth Air Force will remain under the Commanding General, Air Force Combat Command, until the date of embarkation or the completion of the preparatory training, or until the Mobile Reserve Corps is assembled for joint training, at which time control will pass to the Commanding General of the Mobile Reserve Corps.

9. The destination and probable employment of the Fifth Air Force will be most carefully safeguarded, and will be divulged only to persons who, IN ORDER TO PERFORM THEIR TASKS, must receive that information.

10. The Assistant Chief of the Air Staff, A-3, will take such steps as may be necessary to arrange for a concentration and training area for the Fifth Air Force.

For the Chief of the Army Air Forces:

Carl Spaatz

CARL SPAATZ
Brig. General, Air Corps,
Chief of The Air Staff.

1 Incl.- Tab. A.

Concurrences: A.C. of S., WPD
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TAB A

Units required for Task Force One (AAF Component):

Air Corps:	Officers	Enlisted Men	Op. Airplanes	50% Reserve
1 AF Hq. & Hq. Sq.	73	377	13	6
1 Bomb Command, Hq. & Hq. Sq.	29	149	3	1
1 Int. Command, Hq. & Hq. Sq.	31	161	3	1
1 Wg. Hq. & Hq. Sq. (Serv. Com. Hqs.)	13	122	3	1
1 Bomb Gp. Hq. & Hq. Sq. (M)	23	257	5	2
3 Bomb Sqs. (M)	153	738	39	20
1 Recon. Sq. (M)	60	268	13	7
1 Bomb Gp. Hq. & Hq. Sq. (L)	18	245	5	2
3 Bomb Sqs. (L)	75	633	39	20
1 Recon. Sq. (L)	37	233	13	7
2 Pur. Gp. Hq. & Hq. Sqs. (I)	88	468	10	5
2 Int. Cont. Sqs.	12	574		
6 Pursuit Sqs. (I)	246	1260	150	75
1 Observation Group (4 Sqs.)	170	1121	61	31
1 Photo Sq.	42	272	13	7
3 Air Base Gp. Hq. & Hq. Sqs.	60	687		
~~6 Air Base Sqs.~~	42	708	18	9
4 Materiel Sqs.	66	1842	18	9
3 Weather Det.	3	45		
3 Communications Dets.	3	48		
1 Air Dep. Gp. Hq. & Hq. Sq.	14	145	8	4
2 Dep. Sup. Sqs.	18	242		
2 Dep. Rep. Sqs.	18	354		
~~Mech. & Res. Airp. Det.~~	8	300		
Totals	1302	11249	414	207

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Reinforcements: Arms and Services:

	Officers	Nurses	Enlisted Men
Eng. Corps:			
4 Av. Bns. (Sep.)	84		2704
2 Bns. (Sep.)	32		2400
Sub Total Eng. Corps	116		5104
Q. M.:			
4 Trk. Co.	9		330
2 L. M. Co.	4		185
Det. Q. M. Co. Sup. Avn.	3		75
Det. Q. M. C.	18		300
Sub Total Q. M. C.	34		890
Signal Corps:			
4 Air Wing Sig. Co.	12		316
2 A. W. Regt.	128		2492
3 Plat. A. B.	3		108
~~Det. Sig. Serv. Co.~~	3		60
~~1 A. C. Dep. Sig. Sec.~~	4		59
Sub Total Sig. Corps	150		3035
Ord. Dept.:			
3 Ord. Co. AB	12		180
2 Ord. Co. Pursuit	10		166
2 Ord. Co. Bomb	12		362
Det., Ord. Serv. Co.			30
1 Plat Ord Co (P)			
Sub Total Ord. Dept.	34		738
1 Plat Ord Co (B)			
C. W. S.:			
5 Decon. Det.			200
3 Sup. Sec. AB	3		15
3 D. P. Sect.			21
3 Det. C.W.S. (SC)			15
Sub Total C. W. S.	3		251

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	Officers	Nurses	Enlisted Men
Finance Dept.:			
5 Sect. AB	3		30
Sub Total Fin. Dept.	3		30
Chaplain Corps:			
~~1 Sec. Groups & AB~~	8		-
Sub Total Chap. Corps	8		0
Medical Dept.:			
5 Det. Stat. Hosp.	59	85	446
Attached:			
Task Force (A.F.) Hq.	1		8
Bomb Command Hq. & Hq. Sq.	1		8
Int. Command Hq. & Hq. Sq.	1		8
Serv. Command (WG) Hq. & Hq. Sq.	1		8
Pursuit Groups	10		80
Observation Group	7		44
Photo Sq.	1		8
Bomb Groups	11		102
Air Base Groups	12		60
Depot Groups	6		43
Sig. Regts.	10		62
Eng. Bns.	22		74
Sub Total Med. Dept.	142	85	951

1 Sig Co Rad Int

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Recapitulation:

	Officers	Nurses	Enlisted Men	Airplanes
Air Corps	1302		11249	721
Eng. Corps	116		5104	
Q. M.	34		890	
Sig. Corps	150		3035	
Ord. Dept.	34		738	
C. W. S.	3		251	
Finance Dept.	3		30	
Chaplain Corps	8			
Medical Dept.	142	85	951	
GRAND TOTAL AAF	1792	85	22248	721

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145.81-13
13 Feb 1942

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2809-13

DISPOSITION OF U. S. ARMY AIR FORCES

FOR MINIMUM SECURITY

Air War Plans Division
February 13, 1942

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145.81-13
Feb 1942

MEMORANDUM FOR LT. COLONEL H. S. HANSELL:

Subject: Deployment of United States Army Air Forces.

1. This study is furnished in response to your request of January 31.

2. In considering the forces required as set forth herein:

a. No consideration was given to the availability of units.

b. Consideration was given to the immediate requirements for the establishment of forces to accomplish a reasonable security by means of:

(1) A limited aim air defense, and

(2) Reconnaissance-attack patrols.

3. The following is a summary of forces required; amplification is made in reference Tabs:

a. East Coast of U.S., including Newfoundland: (Tab A)

2 Heavy Bombardment Groups
1 Medium Bombardment Group
3 Interceptor Pursuit Groups

b. West Coast of U.S., exclusive of Alaska: (Tab A)

3 Heavy Bombardment Groups
4 Interceptor Pursuit Groups

c. Alaska: (Tab B)

1 Heavy Bombardment Group
1 Interceptor Pursuit Group

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d. Hawaii: (Tab B)

3 Heavy Bombardment Groups
2 Dive Bombardment Groups
5 Interceptor Pursuit Groups

e. Pacific Ferry Route to Far East: (Tab B)

1 Heavy Bombardment Group
2 2/3 Interceptor Pursuit Groups

f. Atlantic - Africa - India Ferry Route: (Tab C)

1 Heavy Reconnaissance Squadron
1 3/4 Medium Bombardment Group
2 Interceptor Pursuit Groups
1 Composite Squadron

g. ABDA Area and Far East: (Tab D)

5 Heavy Bombardment Groups
4 Medium Bombardment Groups
2 Light Bombardment Groups
2 Dive Bombardment Groups
10 Interceptor Pursuit Groups

(Note: The situation in this theater has developed to a point where time and space factors operate against sound strategic planning. It is estimated that plans not now in process of execution can avail us little unless attention is concentrated on India and Burma.)

h. Caribbean Area:

3 Heavy Bombardment Groups
1 Medium Bombardment Group
1 Light Bombardment Group
4 Interceptor Pursuit Groups
1 Fighter Pursuit Group

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i. Iceland:

1 Heavy Bombardment Group
1 Medium Bombardment Group
1 Interceptor Pursuit Group

4. Recapitulation: (See Map of the World, Tab F)

19	Heavy Bombardment Groups
1	Heavy Reconnaissance Squadron
8 3/4	Medium Bombardment Groups
3	Light Bombardment Groups
4	Dive Bombardment Groups
32 2/3	Interceptor Pursuit Groups
1	Fighter Pursuit Group
1	Composite Squadron

5. The size bomber force, operating from bases in England, which is required to appreciably diminish the aircraft production of Germany is estimated at 30 heavy bombardment groups operating over a six month period. (Tab E)

6. Availability of units hinges on:

a. The production of aircraft.

b. The training of combat crews and technical specialists.

c. The production of equipment: radio, armament, organizational equipment, etc.

d. The organization and training of supporting service elements.

e. The rate of commitment of units to combat with resultant high attrition rate.

7. a. The tactical flow of aircraft from production is now being determined by A-3, considering the Bradley Training plan.

b. The availability of combat crews and specialists is being determined by the Training Command, OCAC.

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A

February 4, 1942

MEMORANDUM FOR THE ASSISTANT CHIEF OF THE AIR STAFF, AWPD:

Subject:

1. The Joint Strategic Committee is now preparing recommendations to the Joint Chiefs of Staff for the deployment of all United States Forces - Army, Navy and Air. This section has been requested to furnish information on the following:

a. The minimum pursuit and bomber forces required to defend the vital installations of the West Coast and of the East Coast from sporadic carrier based air attack.

b. The minimum forces required to safeguard exposed points on the air route from the United States to Natal.

2. The minimum pursuit and bomber forces required for the protection of the West Coast was estimated in memorandum for the Chief of the Army Air Forces from AWPD dated February 2, 1942 and consists of 3 heavy bombardment groups and 4 pursuit groups. The minimum pursuit and bomber forces required for the East Coast are estimated in the same letter as two heavy groups, one medium group and three pursuit groups. The forces estimated as necessary in the Western Theater do not include those for Alaska. The forces estimated as necessary in the Eastern Theater do include Newfoundland.

3. The minimum forces required to safeguard exposed points on the air route from the United States to Natal should be considered under the present conditions and again when activity in Africa and the Cape Verde Islands indicates that an air attack on South America can be anticipated. Under the present conditions it is deemed essential that ground troops occupy each of the airdromes in northeastern Brazil. These airdromes are:

Amapa	Fortelesa
Belem	Natal
Sao Luis	Recife
Fernando de Noronha	

It is believed that an airdrome battalion at each field would provide

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the required security. In the event that hostile action in West Africa indicates an air movement to South America, it is believed that at least one heavy bombardment group and one pursuit group should be sent to northeast Brazil for the protection of the airfields.

H. E. PARTRIDGE,
Lt. Colonel, Air Corps.

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c. Items 6 c and d above are critical items which can be determined only after 6 a and b have been determined.

d. Item 6 c above is dependent upon command decisions governed by the strategical situation.

8. It is estimated that complete data for the balance of 1942 on the availability of Army Air Force units will be available in A-3 Division by February 15, 1942.

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February 5, 1942

MEMORANDUM FOR THE CHIEF OF THE AIR WAR PLANS DIVISION:

1. The following estimates are submitted for the information of the Air member of the Joint Strategic Planning Committee, (Lt. Col. H. S. Hansell).

II. Minimum pursuit and bomber forces required to defend:

a. Alaska:

2 heavy bombardment groups.
1 dive bomber group.
2 interceptor groups.

The above estimate is based on the premise that it is easier to defend Alaska than to retake it; that Alaska may easily become that last stepping stone from which to launch an offensive against Japan, and that therefore it is of vital importance not only to hold Alaska, but to protect our present exposed and concentrated installations there from destructive raids. This force provides one Interceptor Group for the defense of Army and Navy Installations on Kodiak Island and one Interceptor Group for the defense of Elmendorf and Ladd Fields. As more bases become available it is believed these groups should be further dispersed. This force also provides a striking unit with the range and the power to meet and destroy any incoming force before it comes within carrier based airplane range of Alaska. The dive bomber group provides a strong force for combating surface and subsurface forces that may escape the heavy bomber force and approach within its range.

Note: A-WPD #1 Figures - 2 Heavy Bomb Gps (136)
1 1/2 Pur. Gps (195)

b. Hawaiian Islands against major attack.

3 groups heavy bombardment.
2 groups dive bombers.
5 interceptor pursuit.

The above force provides one heavy bombardment

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group, one pursuit group and one dive bomber group for Hickam Field; one dive bomber Group and one Pursuit Group for the Kahuku Point Field; one pursuit group and one dive bomber group for Wheeler Field; one heavy bombardment group and one pursuit group for the two fields on Kauai (Burns and Barking Sands); and one heavy bombardment group and one pursuit group for Island of Hawaii (Hilo and Morse Fields). In the ligtt of past experience in the present war this is not considered more than a minimum force for defending an Island group against a major attack.

Note: A-WPD I Gigures 3 heavy bomb Gps (204)
3 Pursuit Gps (390)

2. Island bases from the West Coast of the United States to Australia.

Hawaii - see "b" above.
Palmyra - defended by the Navy.
Canton - Commanding General Hawaiian Dept. recommended no air units and this was approved.
Christmas - 2 Pursuit squadrons.
Fiji Island - 1 pursuit group
2 heavy bombardment squadrons.
New Caledonia - 1 Pursuit Group
2 Heavy bombardment squadrons.

(Signed) S. E. Anderson
S. E. ANDERSON
Lt. Col. Air Corps

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MEMORANDUM TO THE CHIEF, AIR WAR PLANS DIVISION:

Subject: Minimum Defense Requirements for United States Army Air Forces on Atlantic - Africa - India Ferry Route.

1. The ferry route now utilizes the following staging fields:

Bathurst
Freetown
Fishermans Lake
Marshall, Liberia (Firestone Plantation)
Takoradi
Accra
Lagos
Kano
Maidaguri
El Geneina
Ft. Lamy
El Fasher
El Obeid
Khartoum
Wadi Halfa
Aswan
Cairo
Rutba
Habbaniya
Basra
Aden
Jask
Karachi
Hyderabad
Allahabad
Calcutta (Dum Dum)
Bangalore
Columbo

2. Ascension Island will be used as soon as necessary construction and stocking with supplies can be accomplished.

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3. An alternate route through the following from Ascension Island is being surveyed:

Pointe Noire
Zanzibar
Agalega Islands
Chagos Islands
Cocos Islands

4. Only the most western and eastern points in these routes are under immediate threat from enemy action. Bathurst, Freetown, Fishermans Lake, Firestone Plantation, Takoradi, Accra, Lagos, and Kano in the west and Calcutta, Bangalore and Columbo in the east are thus affected. All points on the route through the Middle East would be subject to attack if the enemy obtained control of the eastern Mediterranean. Such an enemy capability should be carefully weighed. Similarly, staging points in India will be threatened, when the enemy obtains control of Burma and free passage for his forces west of Singapore.

5. Plans are now being made to establish a composite squadron of bombers and pursuit aircraft at Ascension Island, and one pursuit squadron at Firestone Plantation in Liberia.

6. The following forces are recommended in addition to the above:

Freetown: (British strategical responsibility)

1 Interceptor Pursuit Squadron
1 Medium Reconnaissance Squadron

Bathurst: (British strategical responsibility)

1 Interceptor Pursuit Squadron
1 Medium Reconnaissance Squadron

Kano: (British strategical responsibility)

1 Interceptor Pursuit Squadron
1 Medium Reconnaissance Squadron

Khartoum:(if Cairo is denied to the AB powers)

1 Interceptor Pursuit Group (less one Squadron)
1 Medium Bombardment Group (less Reconnaissance Squadron)

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Karachi, Bangalore, Calcutta and other points on the West Africa - India ferry route will require air defense forces, when the major hostile threat penetrates the Indian Ocean.

Recapitulation:

	Airplanes
1 Composite Sq.	22
2 Pursuit Groups	160
1 Medium Bomb Group	57
3 Medium Bomb Sqs.	39
1 Heavy Recon. Sq.	8
Total	286

R. C. LINDSAY,
Lt. Col., Air Corps.

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February 10, 1942

MEMORANDUM FOR THE ASSISTANT CHIEF OF AIR STAFF, AWPD.

Subject: Estimate of Air Requirements for the Far East.

1. Discussion.

1. Requirements for combat aircraft in the Far East are so definitely the result of the military operations to be conducted in that area that no sound estimate is feasible unless it be based on such planned or contemplated operations.

2. In arriving at the following estimate the assumption is made that a strategic defensive is to be maintained in the ABDA Area with an objective of holding, as a minimum, the Anzac Area, and that operations are to be conducted in support of the China - Burma - India Area. Based on this assumption the following is considered to provide minimum requirements:

ABDA Theater:

Heavy Bombardment, -	2 groups
Medium Bombardment, -	2 groups
Dive Bombardment, -	2 groups
Pursuit, -	4 groups

China - Burma - India Area:

Heavy Bombardment, -	3 groups
Medium Bombardment, -	2 groups
Light Bombardment, -	2 groups
Pursuit, -	6 groups

O.A. ANDERSON,
Lt. Col., Air Corps.

Air Staff, AWPD

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February 9, 1942

MEMORANDUM TO THE CHIEF OF THE AIR WAR PLANS DIVISION:

Subject: Plan to Diminish Aircraft Production in Germany.

I. PURPOSE.

1. To determine the size bomber force required to appreciably diminish the aircraft production of Germany from bases in England.

II. SCHEDULE.

2. The definite location of the larger assembly plants for aircraft and the important alumina, aluminum and magnesium plants in Germany is not known. It is known, however, that these plants have been considerably increased in size and quantity and greatly dispersed, and that numerous plants in occupied countries contribute to German aircraft production. State Department Cable 177, 3 February, reports aluminum factories at Huyanger, Aura, Odda and Osa in Norway. Destruction of these plants is included in this plan.

3. This plan is based on the latest intelligence but is not up to date. Steps are being taken to secure more recent data which will necessitate later reconsideration. The known plants consist of 27 aircraft assembly plants, 6 alumina plants, 6 aluminum plants, and 4 magnesium plants, excluding those in Norway. (See attached map for location)

4. The necessary air force is contemplated to consist of a bomber command and component units to be based in England and operate from that area during a 6 month period of time when weather is most favorable.

III. ORGANIZATION.

5. The following force will be required to accomplish the result desired. Computations are based on those followed in A-WPD/1.

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a. 27 assembly plants
6 alumina plants
10 aluminum plants
4 magnesium plants

47 vital points in German airplane manufacturing establishments.

b. 47 targets x 30 group missions per target = 1410 Group missions.

c. 1410 Group missions ÷ 8 missions per group per month = 177 group months.

d. 177 Group months ÷ 6 months (operating period) = 30 groups required for 6 months.

IV. EQUIPMENT.

6. From the above, 30 Bomber Groups are needed to accomplish the results based on 8 missions per group per month. Total number of planes (2d Aviation Strength) = 30 x 68 = 2040. Replacements of:

(1) 50% per month would require 1020 per month;
(2) 40% per month would require 816 per month; and
(3) 30% per month would require 612 per month.

7. The necessary Transport Reconnaissance Squadrons and Services must also be provided.

V. CONTROL.

8. To be by Bomber Command specified for U.S.A.F. in England.

R. C. LINDSAY,
Lt. Colonel, Air Corps.

1 Incl. - Map.

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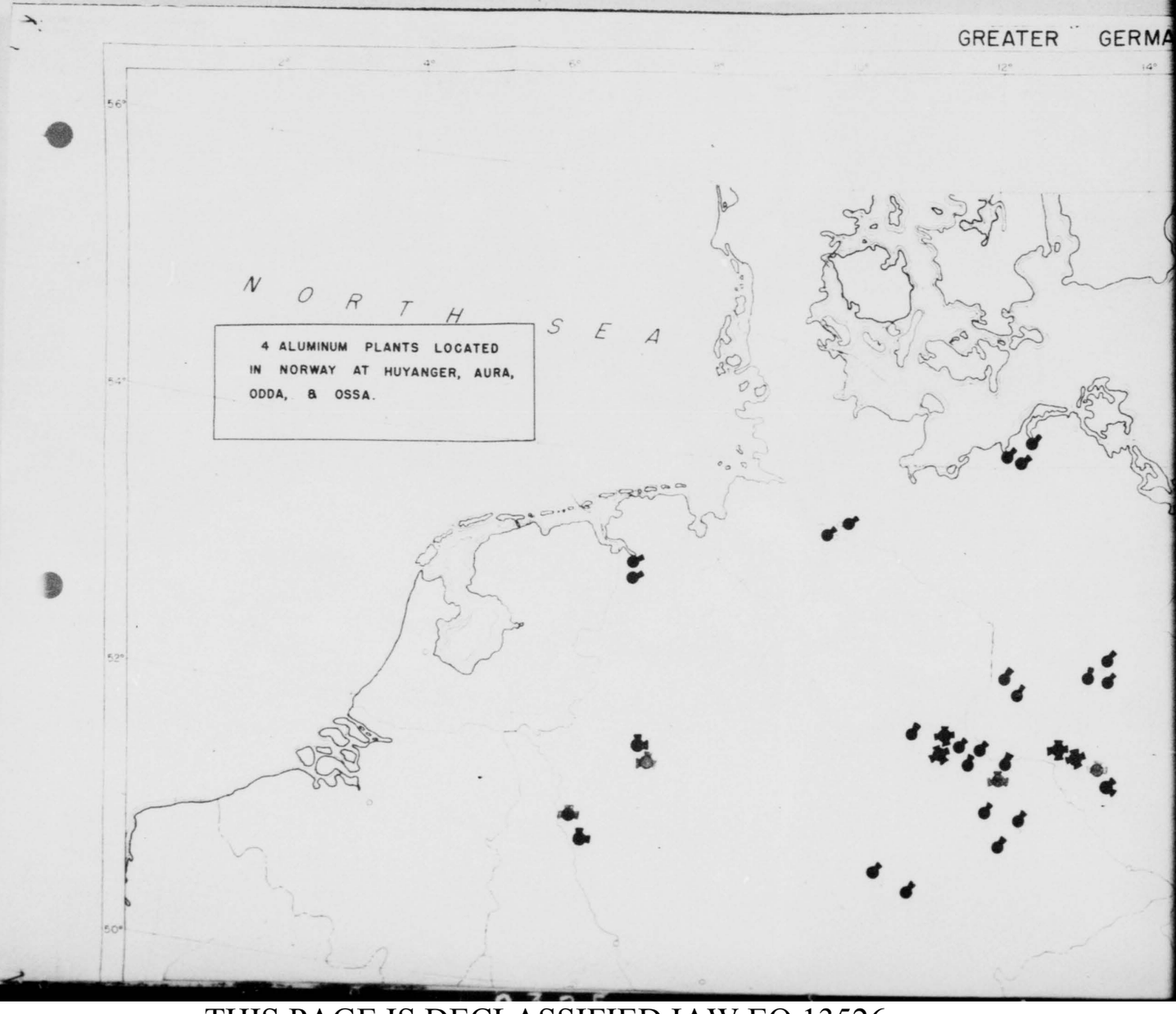

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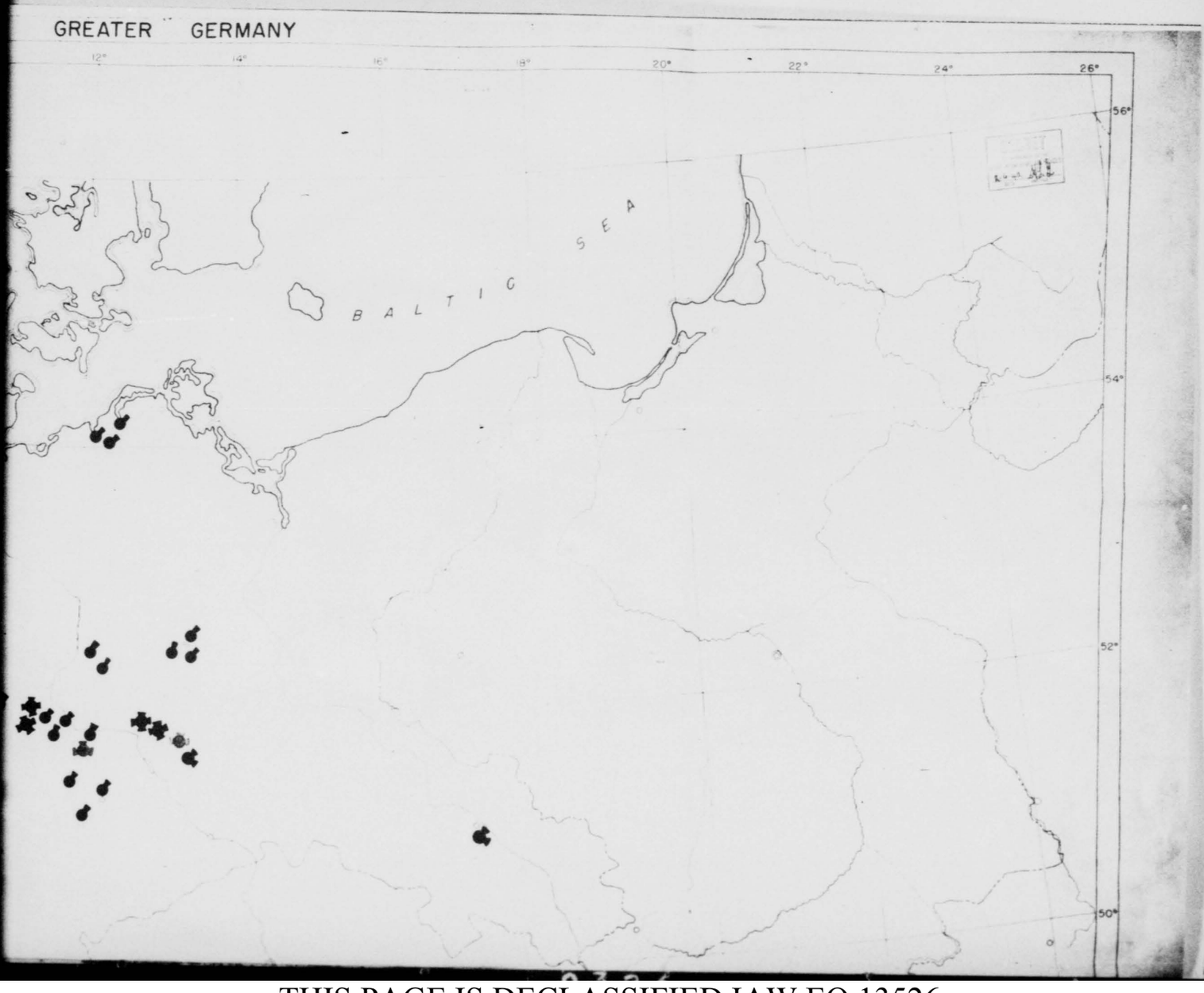

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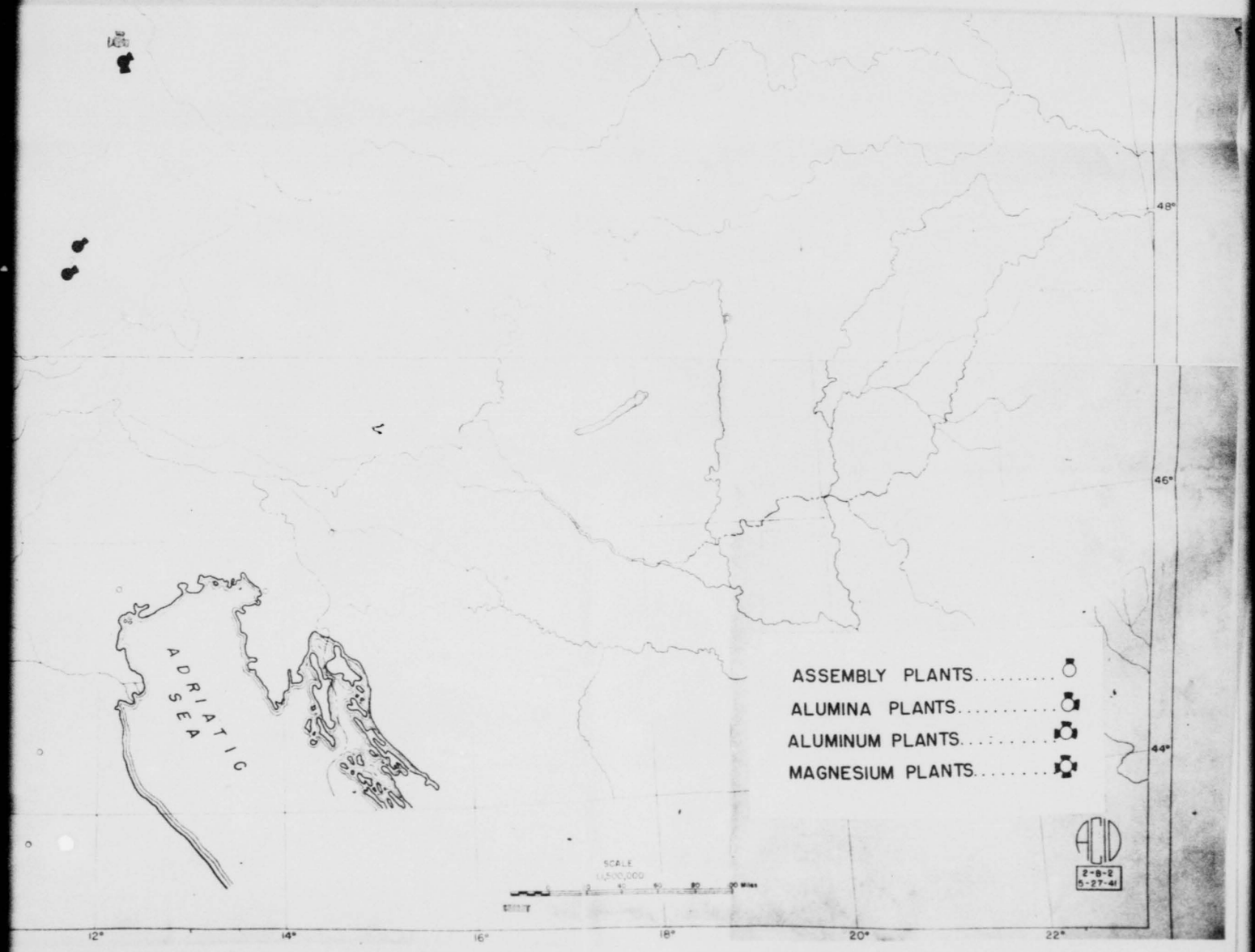

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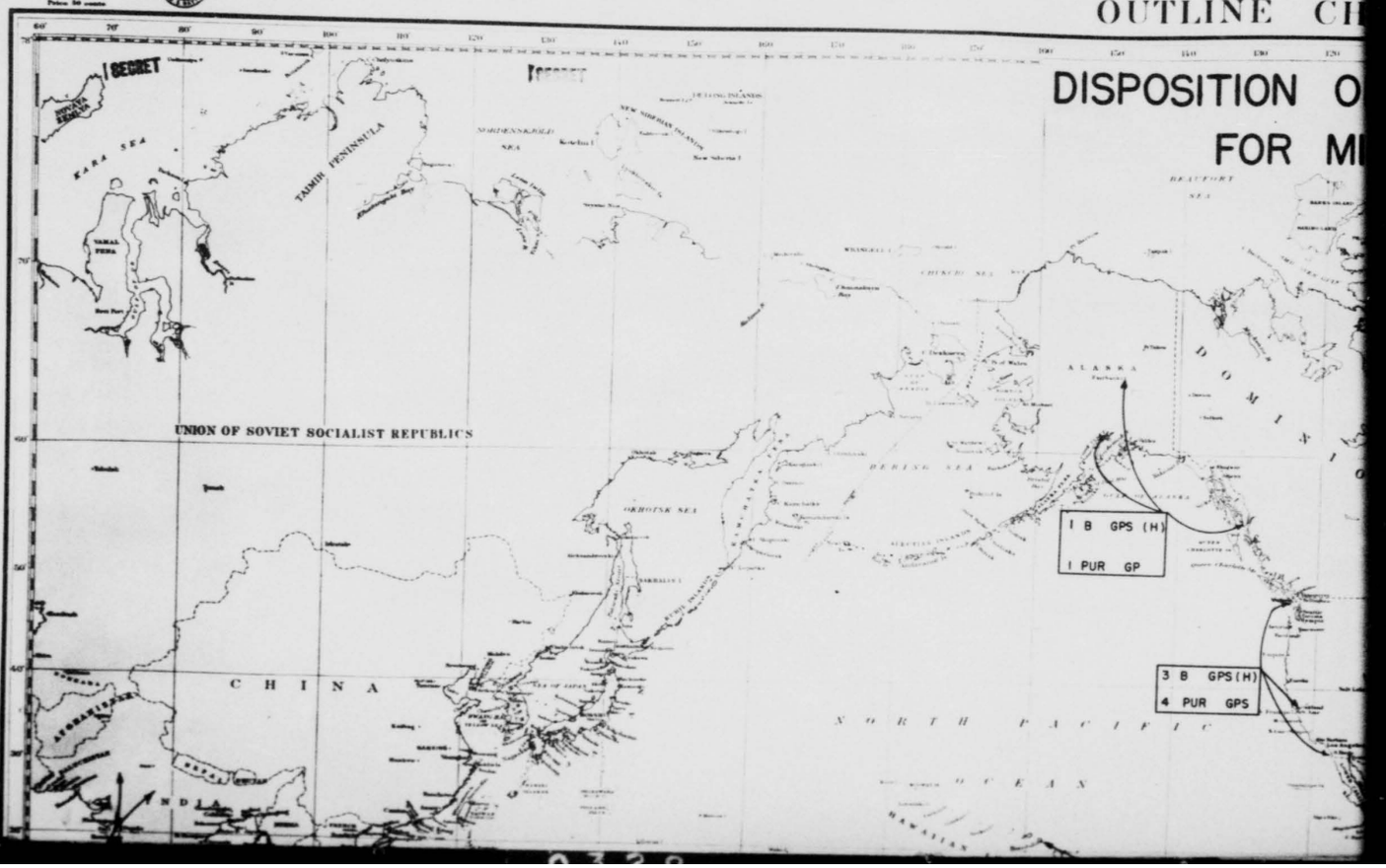

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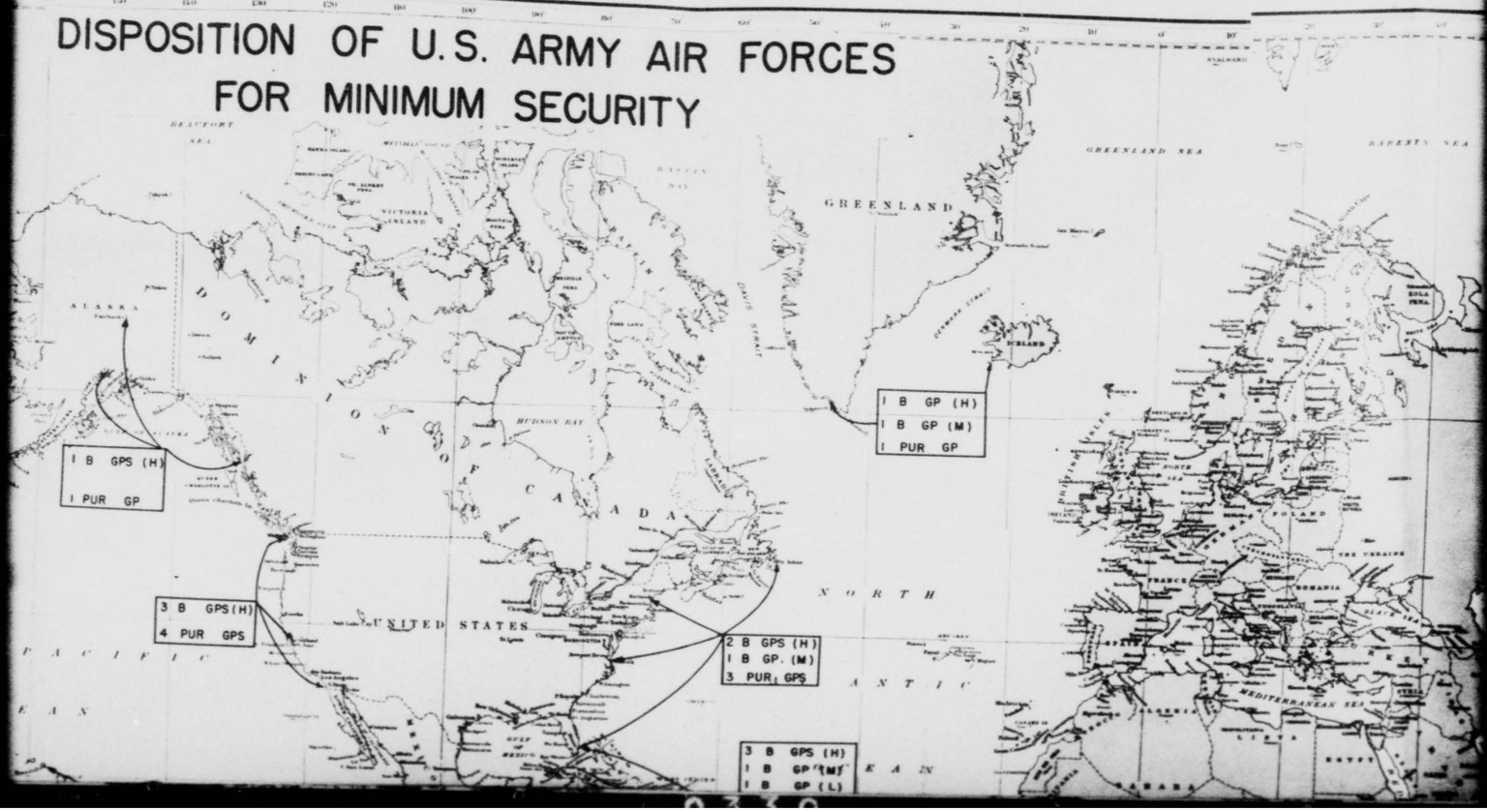
OUTLINE CHART OF THE WORLD

DISPOSITION OF U.S. ARMY AIR FORCES FOR MINIMUM SECURITY



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CHIEF of the ARMY AIR FORCES
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HEADQUARTERS SECOND AIR FORCE
Office of the Commanding General
Fort George Wright, Washington

CONCENTRATION OF COMBAT AND SERVICE ELEMENTS

OF THE AIR FORCE COMBAT COMMAND

IN THE SECOND AIR FORCE AREA

LOGISTICAL AND COMMUNICATIONS PLAN

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I N D E X

		Page (Incl)
Section I	General	1 - 9
	1. Enemy Situation	1 - 3
	2. Factors Influencing Operations	4 - 6
	3. Plan of Operations	6 - 7
	4. Tactical Disposition of Forces	8 - 9
Section II	Service and Supply	10 - 31
	1. General Discussion	10 - 11
	2. Air Corps	11 - 12
	3. Engineer Corps	12 - 14
	4. Quartermaster Corps	14 - 20
	5. Medical Corps	20 - 29
	6. Ordnance	29
	7. Chemical Warfare	29 - 31
Section III	Communications	32 - 36
	1. General	32
	2. Requirements	33 - 34
	3. Organization	34
	4. Disposition of Signal Service Units	35 - 36
Section IV	Miscellaneous	36 - 39
	1. Maps and Charts	36 - 38
	2. Control of Road Traffic	38 - 39
	3. Security	39
Section V	Special Comments	39 - 41

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HEADQUARTERS SECOND AIR FORCE
Office of the Commanding General
Fort George Wright, Washington

July 26, 1941

CONCENTRATION OF COMBAT AND SERVICE ELEMENTS OF THE AIR FORCE COMBAT COMMAND IN THE SECOND AIR FORCE AREA

LOGISTICAL AND COMMUNICATIONS PLAN

FOREWORD: In order to formulate and justify a complete logistical and communications plan for the concentration of the entire Air Force Combat Command in the Second Air Force Area, it is necessary to prepare a complete War Plan incorporating the logistical and communications plan therein.

SECTION I

GENERAL

1. ENEMY SITUATION

a. Hostile Threat: To stimulate interest in the lower echelons, the following hypothetical situation, which would justify the concentration of the entire Air Force Combat Command in the Second Air Force Area for concerted action against an invading force, is used as the basis for logistical and communications planning:

"The circumstances that resulted originally in the transfer of main units of the Pacific Fleet to the North Atlantic Ocean, and which have required their retention there, were seized upon by the Brown coalition on _____, 194 , to make surprise simultaneous attacks upon our Asiatic Squadron and upon the reduced Pacific Fleet. The concerted enemy air and naval action off the Island of Luzon resulted in the complete destruction of the Asiatic Squadron and the investment of Corregidor. The reduced Pacific Fleet had been engaged about three hundred miles west of the Hawaiian Islands by the main Brown force, and had been decisively defeated. Some crippled vessels of our fleet had sailed for the San Francisco area, where

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it is now based. Following this engagement, the Brown coalition immediately invested the Island of Oahu and made landings on other islands of the Hawaiian group. No concerted attack had been made to capture Oahu. The Brown force suffered heavily in the Hawaiian naval engagement and in the subsequent operations so long as the Hawaiian Air Force and land-based naval air units remained operative. The early methodical destruction of air base facilities on the Island of Oahu by the enemy fleet-based air units, and, particularly, by coordinated sabotage on the part of resident Brown agents, resulted in almost complete immobilization of our island air force. Limited reconnaissance of enemy activity has continued."

b. Summary of the Enemy Situation:

(1) Since _____, 194 , the Brown coalition has been consolidating its position in the Hawaiian Islands. Appreciable reinforcements of naval strength, particularly of aircraft carriers, and troop transports and supply vessels have been assembled. It is estimated that the enemy force was of the following strength on _____, 194 .

9 Battleships
17 Cruisers
120 Destroyers
35 Submarines
242 Transports and supply vessels
16 Aircraft carriers
500 Carrier-based aircraft
Miscellaneous naval auxiliaries

The landing force is estimated to be an army of probably two army corps totaling six divisions, reinforced by an armored corps of two divisions. Dive-bombing air units, medium tanks, and heavy artillery are known to be present. On the night of _____, 194 , approximately fifty transports and supply vessels departed under convoy from the Hawaiian Islands. The convoy was last observed about four hundred miles north of Oahu, steaming north at approximately twelve knots. On the night of _____, 194 , the bulk of the remaining Brown force departed in two divisions from the Hawaiian Islands, and has been observed sailing to the northeast. Enemy aerial reconnaissance over the Alaskan coastline has been particularly intensive. Submarines have been active in the vicinity of Kodiak Island, Juan de Fuca Strait, Astoria, and along the northern California coast.

(2) All naval vessels of the hostile force are known to be heavily protected by anti-aircraft guns ranging from three inch to five point nine inch caliber. All vessels are heavily armed with 37 mm AA guns and with AA machine guns.

c. Conclusions:

(1) Enemy Capabilities

(a) The enemy may attempt a landing in force in Alaska. The short line of communication with the home

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WEATHER IS FIRST CONSIDERATION OF AVIATION WARFARE

U. S. Air Force Developing Complete Meteorological Department.

Boston, Aug. 19.—The "phrase military science" has a new and deeper significance in this war, according to Capt. William W. Jones of Massachusetts Institute of Technology.

The general pace of modern warfare is geared to economic production and advances in scientific knowledge, says Captain Jones, who reveals that military aviation cannot act independently of meteorology. He quotes a high ranking British authority who says:

"The chief of a bomber command has to be concerned first with meteorology and secondly with strategy."

In view of this new development in modern warfare the army air force turned its energies to the perfection of a complete meteorological department and is training a full complement of expert weather forecasters for duty with the military forces. Men for this work are handpicked from college alumni, all come highly recommended and many are Phi Beta Kappas.

Special training is being carried out at several of the nation's engineering schools and the best in field equipment is provided as they move into their army stations. Nor is the new branch of the service designed as an emergency measure. Their work will go on in peacetime or wartime—because, as Captain Jones points out, old General Weather is always attacking.

WORLD WAR HORSE RETIRED AT 36 YE[illegible]

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bases and with Vladivostok favors such a procedure. However, the absence of any advantage commensurate with the effort, combined with the disadvantages of terrain and weather, do not recommend such action. Nevertheless, a successful thrust in this area is possible; it may be the main effort, but more probably would be merely a feint. It is estimated that the enemy force that left the Hawaiian Islands _____, 194 , can reach Kodiak Island on about _____, 194 .

(b) The enemy may attempt a raid in force on our Northwest coast with the purpose of destroying naval and aircraft manufacturing facilities, and of interrupting communications. The comparative lack of defenses in this area invites such a move. A landing in the vicinity of Grays Harbor or Astoria, or at both locations, is feasible. Intelligence definitely establishes the fact that extensive preparations have been made in this area for concerted assistance by resident and Canadian alien sympathizers. It is estimated that the enemy force that left Hawaii on _____, 194 , can reach this area on about _____, 194 . The forces that departed from Hawaii on _____, 194 , cannot reach the area before _____, 194 .

(c) The enemy may attempt a landing in the San Francisco area for the purpose of destroying naval and ship-building facilities, interrupting communications, and of forcing strong public demand for strengthening of Pacific naval forces by transfers from the eastern theatre. An attack in this area would meet with considerable resistance, both naval and military; the enemy would encounter greater difficulty in maintaining communications. No advantage that would justify the probable losses is apparent. It is estimated that the enemy forces sailing from Hawaii cannot reach this area before _____, 194 .

(d) The enemy may direct his efforts in the Los Angeles area. The destruction of airplane manufacturing facilities and of naval installations would seriously affect national war preparations. This area thus affords a worthwhile target. However, the risk of strong opposition and resultant delay, coupled with extended communications, renders a thrust in this area improbable. The enemy forces sailing from Hawaii cannot reach this area prior to _____, 194 .

(2) While none of the enemy capabilities enumerated above can be entirely eliminated from consideration, the weight of intelligence at hand indicates that priority should be given to the probability of an enemy feint in the Alaskan area, coupled with a raid in force against our Northwest coast.

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2. FACTORS INFLUENCING OPERATIONS

a. Discussion: In addition to the enemy situation, there are certain factors which will exert a great influence on Air Force operations in the Second Air Force, which in turn have a direct bearing on the logistical and communications equations. These are weather and the topography of the Second Air Force area. In no other Air Force area of the Combat Command does the element of weather have such a direct effect upon aircraft operations as in the Second Air Force area. The low overcast conditions that prevail in the coastal regions; the extreme low temperatures in the northern part of the area; turbulence over the mountain ranges; reduced visibility because of smoke and fog, together with heavy icing conditions encountered at relatively low altitudes during the major part of the year, must all be considered in the initial disposition of field forces and the operations conducted thereafter. The Second Air Force area is essentially an area of "wide-open spaces." It is sparsely populated and contains few large industrial centers. Careful consideration also must be given to the time-space factor in all logistical planning. It must be remembered that the Second Air Force area comprises approximately one-third the territorial limits of the United States. The airline distance from its east to west boundary is greater than the airline distance from Montreal, Canada, to Tampa, Florida. Careful analysis of the weather and terrain factors show that:

(1) Weather: (Refer to Plate I) The area of the Second Air Force can be subdivided into three distinct areas for the purpose of examining weather as related to and influencing emergency air operations. These areas or regions are the coastal region, Great Basin region and the Plains region, and are actually divided by orographical features. Due to these orographical features and the location of the areas resultant weather conditions are influenced.

(a) In the coastal region air operations can be conducted with little, if any weather interference during the summer months. These months are marked by mild weather conditions. Stratus decks are prevalent during the period, but usually good ceilings exist below the deck, along with good visibilities, except that during occurrence of forest fires, smoke will often limit visibilities to less than one mile in certain areas. Occasionally a frontal passage will occur during this period, which may limit operations for a short duration. However, during the other months of the year, especially the winter months, air operations will become dependent to a great extent upon existing weather, hence any scheduled or extended operations would be affected. Frontal passages normally occur in frequent intervals. After passage, typical instability conditions are prevalent for a few days. During days when a marked inversion exists, fog mixed with smoke is prevalent throughout all the valleys which drain toward the sea. These fogs are known to persist for weeks, and very often do not dissipate throughout the day. Also, during these months, the zero isotherm is often at very low levels; hence the altitude at which surface icing of aircraft

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occurs is rather low. Turbulence occurs in all frontal passages, as well as in the thunderheads during invasions of Polar-Pacific air.

(b) The Great Basin region is marked by its excellent flying weather during the summer months. Even during the spring and fall seasons, very little weather occurs to hamper operations. In the winter months, occasional frontal passages occur which would limit flying for brief periods of time. However, in some localities, due to topographical features, operational weather may be more severe, but if careful location of selected airports is made, these local phenomena can be avoided. Over the mountain areas of the region, during passage of frontal systems, violent turbulence and icing in cloud formations will occur.

(c) In the Great Plains area, which is normally invaded by polar continental air masses, characteristic weather will occur. Since the region, except near the mountains, is fairly level, weather throughout the year offers no serious handicap to operations.

(2) Terrain Appreciation of the Second Air Force Area: (Refer to Plate I.) The coastal plain along the Pacific Ocean is intermittently rugged and interspersed with sandy strips, but quickly slopes up into the broken and rough terrain of the low Coast Range. The Coast Range extends from south of the Oregon line to the tip of the Olympic Peninsula, broken only by the following rivers -- Rogue River, Umpqua River, Siuslaw River, Columbia River and Chehalis River, of which the Columbia River is the most important. The Coast Range of mountains average elevation is from 2,000 feet to 4,000 feet, except on the Olympic Peninsula, which has several peaks as high as 6,000 feet elevation.

Between the Coast Range of mountains and the Cascades is a wide, low valley starting in southern Oregon and extending north to the Puget Sound. This valley is broken by the Calapooya Range south of Eugene, Oregon, is crossed by the Columbia River near Portland, Oregon, and is broken and rough in the State of Washington.

The Cascade Mountains constitute a continuous range from California to British Columbia, broken only by the Columbia River Gorge. This range averages 5,000 feet elevation with peaks higher than 14,000 feet, and presents a formidable mountain barrier with very few passes. East of this range in Oregon is a broken plateau 1,500 feet to 5,000 feet in elevation, extending to the Blue Mountains on the east boundary of Oregon. East of the Cascade Range in Washington is a high, flat plateau crossed by Columbia River. The plateau extends East to the Bitter Root Range of mountains in the Idaho Panhandle, another formidable range. This range is separated from the Blue Mountains in Oregon by a broken valley extending south and east into the southern part of Idaho, which is high desert 2,000 feet to 5,000 feet in elevation.

The Bitter Root Mountain Range and the Blue Mountains are the beginning of a series of parallel mountain ranges extending generally

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north and south that merge into the Rocky Mountain Range -- a range that extends north and south the full length of the North American continent and is from 300 to 500 miles wide through the states included in the Second Air Force Area. These mountains with an elevation of from 5,000 feet to 14,000 feet form a barrier through the United States with passes over 5,000 feet in elevation east and west.

The Rocky Mountains' eastern extremity is generally a line through central Montana, includes Wyoming and goes through Colorado. From this line to the east are the Great Plains of the Mississippi Valley, sloping generally from an elevation of 6,000 feet down to the Mississippi River.

3. PLAN OF OPERATIONS

a. Discussion: Logistical and communications planning is predicated almost entirely upon the probable employment of an Air Force. The employment of an Air Force in a theatre of operations is influenced to a large extent upon the operational characteristics of the aircraft with which the units are equipped. Reconnaissance Units will in general be dispatched to a theatre of operations in advance of the remaining Combat Units in order that the Commander may have a forewarning of the enemy's intentions. It may be expected that all types of Reconnaissance Units, operating from advanced bases, will be dispatched to their extreme ranges. Reconnaissance Units will be required to destroy lucrative targets encountered in their search areas, provided that the basic mission of locating the enemy and reporting his whereabouts is not interfered with. Once contact with the enemy is made, it may be expected that Heavy Bombardment Units will be dispatched to intercept and attack the enemy at extreme ranges in order to confuse and interfere with his plan of action, and to further determine what his intentions are. Medium Bombardment can also be used effectively in attacking the fleet and convoy when they approach close to the shoreline. In operations against the hostile flotilla, target priorities in general are:

First priority -- Aircraft carriers
Second priority -- Troop transports
Third priority -- Capital vessels

During beaching operations by the enemy, it is highly probable that all types of aviation in the Combat Command will be employed in a concerted effort to destroy the enemy during his most vulnerable phase of action. If a beachhead is effected and the enemy lands in force, it is believed that Heavy Bombardment and Reconnaissance Units will be employed against the enemy's supply lines at a considerable distance to the rear. Medium and Light Bombardment Units must be prepared to support our ground forces either in direct or close support. Fighter Type Pursuit Units will be utilized to protect our most expensive and most vulnerable units. Their employment must be such that maximum protection is afforded to the supported units. All Interceptor Pursuit Groups of the Third, Fourth and First Air Forces, with the exception of one wing (less a group) which is retained at Salt Lake for protection of the Ogden Depot, are assigned to the Second Interceptor Command. They operate under the direct control of the Second Interceptor Command in accordance with the Second Interceptor Command defense system

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now in effect. Mobile echelons of the Fourth Interceptor Command and Third Interceptor Command are employed to supplement the Second Interceptor Command Defense.

As a basis for computation in logistical planning, the following operational requirements are set forth:

Heavy Bombardment and Reconnaissance Units - Perform one mission daily, six (6) hours duration.

Medium Bombardment and Reconnaissance Units - Perform one and one-half missions daily, three (3) hours duration each mission.

Light Bombardment and Reconnaissance Units - Perform two missions daily, two (2) hours duration each.

Fighter Pursuit Units - Perform one mission daily, five (5) hours duration.

Interceptor Pursuit Units - Perform two missions daily, one and one-half (1-1/2) hours duration each.

As a further basis for computations, units are soon to be equipped with:

Heavy Bombardment and Reconnaissance Units	-- 1/2 Units with B-24 type airplanes 1/2 Units with B-17 type airplanes
Medium Bombardment and Reconnaissance Units	- 1/2 Units with B-25 type airplanes 1/2 Units with B-26 type airplanes
Light Bombardment and Reconnaissance Units	-- A-20 type airplanes
Fighter Pursuit Units	-- P-38 type airplanes
Interceptor Pursuit Units	-- P-40 type airplanes

Airplanes of the different types are assumed to be the latest series now in production and a further assumption is made that 75 percent of the authorized airplane strength of each unit is available for continuous operations. The operational requirements listed above would appear to be high for operations over an extended time, but any contemplated operations which would justify the concentration of the entire Air Force Combat Command in one theatre of operations in the United States would be operations conducted at such a tempo as would tax the capabilities of both equipment and personnel.

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4. TACTICAL DISPOSITION OF FORCES

(Refer to Plate 1A)

a. General Discussion: In the disposition of field forces, an effort is made to maintain the integrity of the separate Air Forces, both for the simplification of the supply and communications problems and for simplification in operations. Each Air Force of the Combat Command is assigned a definite operating sector. It is realized that the disposition of the field forces in the theatre of operations is normally a function of the supreme commander. However, as a basis for logistical planning, units of the four Air Forces are initially assigned to airdromes in each operating sector that are suitable for their operational requirements and in accordance with the general tactical plan. Three Air Forces are placed abreast in the northwest part of the Second Air Force area with the remaining Air Force in the Salt Lake-Ogden-Pocatello area. No attempt is made to include the midwestern part of the United States contained in the Second Air Force area in the concentration plan due to the fact that the distance from the midwestern part of the country to the Pacific Coast is so great that units located thereat are not in a position to support Air Force action by the Combat Command. It is believed that any concentration that warrants the concerted action of four Air Forces in a general theatre to counteract a common hostile threat must be a concentration in which all units of the fighting forces are in a position to contribute to the fight.

b. Factors Influencing Disposition: The availability of suitable airdromes and their location in the theatre of operation exerts the greatest influence on the disposition of field forces. It is difficult at first to realize the tremendous requirements in operating airdromes demanded by a concentration of the entire Combat Command in any one particular area of this country. Maximum use must be made of all existing airdromes. It is readily apparent that at the outbreak of hostilities, unless our airdrome expansion program is greatly increased, it will not be possible in the Pacific-Northwest to operate from squadron airdromes. Units must be concentrated with a minimum of one group to an airdrome. Dispersion of aircraft and installations at each operating airdrome will be extremely difficult, and the congestion thereat caused by refilling operations presents a profitable target to the enemy. Hence, it is essential that local air superiority be maintained at all airdromes that are vulnerable to hostile air attack. It can be seen from Plate 1A that the initial disposition of the Air Forces is essentially one in depth. This is due, not so much as to the desirability of protecting certain elements of the Combat Command by removing them as far from the point of contact as is consistent with their operational role, as to the fact that airdromes in the forward areas are extremely scarce. Arrangements must be made for temporary bases in the forward area to be used during certain critical phases of operations by units in the rear as refilling points, in order that their range be extended. The general location of the various units of each Air Force area, with the exception of the Air Force assigned to the Salt Lake area is as follows:

(1) Interceptor Pursuit: As heretofore stated, all Interceptor Pursuit Groups, assigned and attached to the Second, Third and Fourth Air Forces, are distributed along the general line of Seattle-Portland-Roseburg, at bases from which they will be able to fit in with the Second Interceptor

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Command scheme of operations.

(2) Reconnaissance: Initial disposition of all Reconnaissance Units is as close to the enemy as conditions permit, in order that contact be made with the enemy at maximum range. Hence, Reconnaissance Units are assigned to coastal airdromes until such time as the situation forces them to withdraw to east of the mountain ranges.

(3) Light Bombardment: Light Bombardment is essentially short ranged aviation. It is used to best advantage against the enemy during its landing operation and in the destruction of beachheads. It is, therefore, based within the probable theatre of landing operations. During the major part of the year weather conditions do not permit flights from one side of the Cascade Mountains to the other, except under instrument conditions. Light Bombardment Units are in general located west of the Cascade Mountains in range of Pacific coastline.

(4) Medium Bombardment: Medium Bombardment has slightly more range than Light Bombardment and must, therefore, be based in a position to reach its possible objectives. Medium Bombardment bases are in general along the line parallel to the coast, approximately 250 miles inland.

(5) Heavy Bombardment: The operational characteristic of Heavy Bombardment, together with the vulnerability factors involved, influences the distribution of Heavy Bombardment Units. Suitable airdromes are generally available along the line approximately 400 miles from the coastline. The distribution of Heavy Bombardment Units along this line offers them protection from hostile air attack and permits Heavy Bombardment operating through advance refilling points to contact the enemy a considerable distance seaward.

(6) Fighter Pursuit: Units are located in a position to render escort service to elements of the Bomber Command. Fighter protection is worthless unless the protection is afforded at points where interference by hostile Interceptor Pursuit occurs. The location of Fighter Pursuit stations must, to a certain extent, be flexible. When Heavy Bombardment conducts long-range operations, it may be necessary to move the Fighter Pursuit Units forward to advance bases in order that their range be sufficient to permit proper escort operations. They are in general located along the Light Bombardment line east of the Cascade Mountains, at points at which weather conditions will permit their rendezvous with the escorted units.

(7) Transport Units: All Transport Units are retained at the Pursuit Wing Headquarters to which they are normally assigned in order that they may be used effectively to transport Pursuit Unit personnel, and to facilitate supply service between the DP's, sub-air bases and air bases.

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SECTION II

SERVICE AND SUPPLY

1. GENERAL DISCUSSION

a. Concentration: Concentration in the theatre of operations of the Air Force Combat Command will be by Air Forces in order that their integrity as administrative units may be preserved. Each Air Force will move into its assigned Air Force Service Area by air, rail or motor over prescribed air routes as indicated hereafter, and over rail or motor routes as determined by the Air Force Commander, depending upon the situation, season of the year and availability of roads and railroads. Priority of movement to be given to the Third Air Force in order that it may clear routes to concentration and the Air Force Service Areas of the First and Fourth Air Forces prior to their occupancy of their assigned areas. It is contemplated that units of the Second Air Force now occupying stations outside the Second Air Force Service Area will have cleared other Air Force Service Areas prior to the arrival of other Air Forces.

b. Reception: The theatre of operations is divided into Air Force Service Areas which have been subdivided into Air Base Areas with air bases, sub-air bases and DP's as indicated on attached plates showing the disposition of combat and service units. Provision has been made for the stockage of supply points with a ten-day supply of balanced stocks. It is desirable that organic service units precede the combat units into the concentration area by ten days, if the situation permits. Air base and sub-air base commanders will personally survey their assigned air bases and sub-air bases prior to the arrival of combat units to inform themselves of existing conditions and to locate railheads and refilling points for the units to be served.

c. Service and Supply: The service and supply of the Air Force Combat Command in the theatre of operations has been organized in such manner as to permit each Air Force to function as an administrative unit, thus permitting one or more Air Forces to be moved to another theatre of operations without disrupting the service and supply functions of remaining Air Forces. For supply of items common to Air and Ground Forces, existing Ground Force supply points have been utilized. The use of such supply points has been coordinated with and approved by the Commanding Generals, Fourth Army and Ninth Corps Area. Depots, air bases, and sub-air bases have been located on rail lines, with adequate facilities to provide supplies necessary to the conduct of operations with the minimum of back-haulage considering the scarcity of railroads in this area of great distances. Air transportation of supplies between depots, air bases, sub-air bases and DP's will be utilized to the limit of availability; however, due to distances between supply points in this theatre, four additional transport squadrons should be provided to supplement the organic transport units. Hard-surfaced roads link the majority of supply points and generally parallel the railroads in this area. However, the roads and railroads of the Fourth Air Force Area do not connect the supply points in the eastern and western

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sections of the area, thus requiring a certain amount of back-haulage to supply certain points of the area. The initial supply stockage will be placed as nearly as possible to the using units, and credits will be set up for its withdrawal on call. Credits will be set up in depots located in the rear of the Air Force Service Area and in the communication zone, and will be delivered on draft. Supplies, transportation and labor will be difficult to obtain locally as there are few large centers of population in the northwest area, and the area as a whole is sparsely populated.

2. AIR CORPS

a. The situation as outlined indicates air action which presupposes certain losses in airplanes and personnel together with an increase, over normal operations, in requirements of spare parts. Complete replacement airplanes, airplane equipment, spare parts and supplies required to maintain all airplanes in commission will be secured from air depots in the communication zone or zone of interior. Complete airplanes will be flown by ferry pilots from such depots to Air Force Replacement Depots. From these replacement depots, they will be flown to units in their Air Force Service Area requiring replacement airplanes. Spare parts and other supplies necessary to maintain the airplanes will be delivered by transport airplanes to the using unit by the same channels as indicated for the complete airplane. Air Force Replacement Depots will be established at each Air Base.

Based on estimated losses during the first ten days of combat, an initial stockage of approximately thirty percent of authorized allowances of complete airplanes, spare parts, and supplies necessary to keep authorized and replacement airplanes in commission will be stocked at Air Force Replacement Depots serving the units. The estimate is based on the expected percentage of loss per sortie for the number of sorties contemplated from the several types of combat units participating.

Type	Average Sorties Per Day For First 10 Days	Percent of Loss Per Sortie	Percent of For First 10 Days' Operations
B (H)	1	2	20
B (M)	1-1/2	2	30
B (L)	2	3	60 McChord Units
P (I)	2	1-1/2	30
P (F)	1	3	30

Losses of all reconnaissance units the same as corresponding type of bombardment units.

NOTE: Losses shown above for light bombardment units apply only to those units based at McChord Field. Other units of this type have been based farther in the rear, due to scarcity of suitable airdromes in the forward areas, and their expected losses would

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be based upon their participation in action as influenced by the changing situation. Losses--other than McChord Units--estimated 30%.

b. All combat units will arrive in their concentration area with airplanes equipped with full military load (less bombs) and with complete combat crews.

c. Units moving into the concentration area will take items of equipment for mobilization, as listed in Air Corps Tables of Basic Allowances, applicable to the particular unit. Maintenance equipment, spare parts, and kits necessary to accomplish first echelon of maintenance, will be taken from home stations.

d. Airplanes will be camouflaged with current color scheme prior to leaving home stations.

e. All airplanes will be equipped with oxygen and oxygen equipment.

f. Gas and oil requirements for movement into the concentration area and for operation of all units after their arrival in such area is covered in attached "Servicing Plan - Aviation Gas and Oil."

3. ENGINEER CORPS

a. General Discussion: At the present time the lack of airports throughout the Second Air Force does not permit of the proper dispersion of units of the Air Force Combat Command. Every available field will be used for the concentration and contemplated operations, and all airports will be overcrowded. Ordinarily, one of the first missions assigned to Engineer troops would be the construction of satellite fields for the proper dispersion of units. In the present case, however, it is even more important that airplanes be dispersed on each individual airport. Present peacetime construction of civilian airports does not allow dispersion of aircraft, and the construction of hard standing and taxiways for this purpose would be necessary. Other important missions of Engineer troops are to repair and maintain landing fields and to assist in the defense of air bases by supervision of the construction of fortifications, obstacles, and airplane revetments. The complete inadequacy of Engineer troops now assigned to the Air Force Combat Command precludes their use on all these missions, and makes it necessary to select priorities.

b. Troops Available: The Engineer troops now available for use in the concentration of the Air Force Combat Command consist of one regiment less one battalion -- the 21st Engineers Aviation, Air Force Combat Command, and two battalions -- the 803d Engineer Battalion Aviation, First Air Force, and the 810th Engineer Battalion Aviation, Third Air Force.

c. Missions: Based on the above considerations, Engineer units will be assigned missions as follows:

First Priority. The providing of hard standing and taxiways for the dispersion of aircraft located at exposed airports. Assistance will also be given in the construction of revetments and camouflage, and in the

0351

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preparation of airport defense plans. However, Engineer troops are not sufficient for use in actual construction incident to airdrome security. At places where Air Corps troops or other service troops are not sufficient, civilian labor must be called upon.

Second Priority. The improvement of airports required as refilling points. These are Ephrata, Washington, and Redmond, Oregon. It is believed that improvement of these fields by civilian agencies will be so slow that they will not be entirely suitable for Air Force operations of the magnitude contemplated until the spring of 1942.

Third Priority. The construction of satellite fields in the vicinity of air bases for the dispersion of units.

c. Initial Location of Engineer Troops: The initial locations of the Engineer units will be as follows:

One battalion of the 21st Engineers will be attached to the Second Air Force. It will be located initially at Fort Lewis, Washington (immediately adjacent to McChord Field).

The 810th Engineer Battalion will be based at Vancouver Barracks, Washington (immediately across the Columbia River from the Portland Air Base).

The 803d Engineer Battalion will be attached to the Fourth Air Force, and will be based initially at Medford, Oregon.

The 21st Engineer Regiment (less two battalions) will be based initially at Fort George Wright, Washington, to be used where it is most needed at the time operations begin.

d. Initial Operations: As stated above, Engineer troops will be employed initially on work necessary for the dispersion of aircraft at exposed airports. In order of priority for each Air Force, Engineer troops will be assigned to tasks at stations as indicated:

Second Air Force

1. Arlington
2. Port Angeles
3. Aberdeen
4. Bellingham
5. Olympia
6. Everett
7. Kitsap County

Third Air Force

1. Astoria
2. Chehalis
3. Portland
4. Hillsboro
5. Salem
6. Vancouver

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Fourth Air Force

1. Eugene
2. Medford
3. Roseburg
4. Klamath Falls

In the accomplishment of these tasks, companies will be detached from battalions until the work is completed in accordance with priorities listed. The estimated time of completion of dispersion projects listed above is one month. The 21st Engineer Regiment (less two battalions) will be employed initially on the improvement of the airports at Ephrata, Washington, and Redmond, Oregon.

f. Supplies:

(1) Depots. The Engineer personnel now assigned to the Air Force Combat Command is entirely inadequate to maintain depots necessary for the furnishing of Engineer Class IV supplies. It will be necessary to depend upon ground force agencies for the establishment of these supply points. However, since most of the ground force depots will be located comparatively close to the front, it is necessary to have one branch depot of Engineer Class IV supplies near the rear boundary of the Air Force Service Area. The branch Engineer depot is located at PASCO, WASHINGTON, because of the availability of suitable rail and storage facilities. It will be operated by the Supply Platoon, Headquarters and Service Company, 21st Engineers.

It is assumed that ground forces will have Engineer depots west of the Cascade Mountains and located in the vicinity of Portland, Oregon, and Tacoma or Seattle, Washington.

(2) Refilling Points. In order to effect distribution of Engineer Class IV supplies, refilling points should be located at several points in each Air Base Area. However, the lack of personnel precludes the establishment of more than four. Refilling points will be provided only at the four exposed Air Bases of EVERETT, McCHORD FIELD, PORTLAND, and MEDFORD. They will be operated by the RP Section of Headquarters and Service Company, 21st Engineers.

4. QUARTERMASTER CORPS

a. General Discussion: For planning purposes, it is assumed that upon the opening of hostilities or attack, our ocean-water transportation cannot be depended upon for normal replenishment of supplies. However, at least ten days' stockage of Class I and III supplies are in the various coastal towns. Therefore, the plans are drawn up to provide replenishment of supplies by rail, motor and commercial motor transportation to all points within this area.

b. Supplies:

(1) Class I--Rations. Field Ration A prescribed for all participating troops within the combat zone. Travel rations will be provided

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for troops traveling from home station to assigned areas in the combat zone. A ten days' supply of rations will be stocked at each air base and sub-air base. Perishable supplies will be stocked for five days only and available in refrigerator cars spotted at direction of the DP officers. The supplies will be available upon arrival in the assigned areas. Automatic supply will be made to all bases and sub-bases on credits established at the designated depots in the zone of communication. The SEATTLE depot will continue to supply troops west of the Cascades until the supply is exhausted or destroyed, after which depots at OGDEN and MISSOULA will be prepared to furnish all Class I supplies.

(2) Class III--Gasoline, Oil for Cooking, Oils and Greases for Motor Transportation. Requirements are based on table of organization strength of each organization assigned to the maneuver area, plus 10 percent. A ten days' stockage of all Class III items will be made at each air base depot and sub-air base depot within each zone of operation prior to the arrival of troops. Supplies to be automatically based on credits set up at Class III depots located as follows: for the Second Air Force, at SEATTLE, SPOKANE and MISSOULA; for the Third Air Force, at PORTLAND, PENDLETON and UMATILLA (gasoline only); for the Fourth Air Force, at BOISE, MEDFORD and EUGENE; for the First Air Force, at WENDOVER, BURLEY and OGDEN.

(3) Procurement of Class I and III Supplies. This will be based on ten days' stockage at each air base and sub-air base, as indicated on Plates pertaining to each Air Force, after which supplies will be obtained on daily telegram from each air base and sub-air base Quartermaster to Air Force Quartermaster, and forwarded to the assigned depot in zone of communication. It is assumed that all Quartermaster vehicles have been distributed to all organizations in each Air Force in accordance with definite plans of the War Department. Replacement parts for all motor vehicles are to be in accordance with existing instructions by means of established credits, as set up at motor depots located within the area. Those assigned are as follows: for the Second Air Force, MISSOULA; for the Third Air Force, PENDLETON; for the Fourth Air Force, BOISE; for the First Air Force, OGDEN. Sufficient tents will be stocked in each depot in the zone of communication to make replenishments of all tentage in the combat area.

(4) Storage. Storage of all supplies will be made at rear depots in the zone of communication, depots located at air bases and sub-depots located at sub-air bases within the operations area, as indicated on the operations map. Distribution will be automatically from depots in zone of communication to air base depots and sub-air base depots by daily trains; and from sub-air base depots to organizations by means of Quartermaster Truck Companies, by air transport, and, if necessary, by organizational transportation. The operations map shows units as assigned to the Pacific area to be supplied.

c. Procurement and Disposition of Real Estate and Facilities Including Leasing: Present instructions require that this be a function of the zone Constructing Quartermaster, Ninth ~~Sub~~ Corps Area. In case of an emergency, this will be the responsibility delegated to a qualified agent within each Air Force. For this problem it is assumed that sufficient space is available at designated air bases and camp sites without additional leasing.

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d. Procurement and Operation of Quartermaster Supplies, Storage, Maintenance and Repair Facilities: These operations will be maintained by Air Base Administrative Quartermaster Personnel for all troops stationed at each air base and its sub-air base or bases. The Quartermaster Tactical Personnel, assigned to the DP officers, will maintain all facilities for storage, maintain and repair all facilities for units stationed at or near the respective DP's. All operation to be in accordance with general instructions now in effect, as adapted to war-time conditions. Accountability and availability of funds will be given due consideration.

e. Services:

(1) Labor Pool. At each air base labor will be supplied from Quartermaster Air Base Administrative Personnel, which may be augmented by the hire of labor available in local centers of population.

(2) Salvage. All salvage items to be collected by DP officers or sub-air Quartermasters and forwarded to the next rear air base or sub-depot daily, or whenever empty trucks and daily trains are returning to a rear destination for replenishment of supplies. It will be the duty of the air base Quartermaster to collect and segregate all items that can be repaired and returned to the using organizations with speed and economy. All metals and materiels which cannot be returned to service will be sent to depots in the zone of communication, as may be directed by higher authority, for reclamation.

(3) Graves Registration. In view of the fact that the Air Force organization does not provide for troops of this category, it will be necessary to request assignment of a Quartermaster Company (G.R.) from higher authority; one platoon for each Air Force combat area is considered adequate. Burial will be made in cemetery or plots as designated by the Commanding General of each Air Force.

(4) Motor Transport Service and Motor Maintenance Units. Motor transport service will be maintained by the use of truck companies at air bases and sub-air bases, as indicated on the operations map for each Air Force. They will be used mainly for hauling supplies from designated depots to sub-air bases or DP's; troops to be hauled in general but short distances as may be required in the tactical situation. Light Maintenance Units are assigned to air base depots and sub-air base depots, as indicated on the operations map. Work to be performed by these units will include the Third Echelon Maintenance only. Vehicles requiring Fourth Echelon repairs will be evacuated to rear establishments located at the main depots.

f. Transportation of Supplies and Troops:

(1) By Land. For supplies, it will be necessary to use tactical vehicles assigned to each unit within the sphere of action, as directed by the Commanding General of each Air Force and augmented by limited use of the truck companies for supplies from air base depots to distributing points or between the air bases and the sub-air bases. Long hauls of supplies will be made by train from the depots to rail heads or air bases, as may be found to be most economical by the Commander of the Air Force sector, as coordinated through the Commanding General of the Air Force Combat Command. For

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moving troops, it will be necessary to use trains where mass movement is desired within the combat zone. This, of course, will depend upon the tactical situation. Most troops in the Air Force will be shifted by means of motor transports or the use of air transport.

(2) By Water. The transportation of supplies and troops by water can be carried out only in a very limited degree within the Puget Sound area and possibly on the Columbia River area as far as Pasco, but due to the slowness of transport, this method of transportation is not considered to be of great value after hostilities start. The only possible supplies that could be carried on the Columbia by means of barges would be gasoline and other bulky supplies now stored in the vicinity of Portland, and then with great hazard, due to the fact that the Bonneville Dam is likely to be damaged to such an extent that this means of transportation would have to be eliminated.

(3) By Commercial Motor Freight. The use of commercial motor freight would be of inestimable value at or near the opening of hostilities in that this type of service could be made available for rapid movement of perishable supplies to air base depots and sub-air base depots, or any point of stockage, particularly when refrigeration is of vital importance. Such items as lard, butter, eggs, fruit and vegetables are considered in this category. This transportation can also be used to augment military vehicles where there might be a temporary shortage of transportation for hauling any class of supplies, particularly during the early concentration of troops in the designated zone of operation.

K. Bivouac:

(1) Types. There are three general types available, or to be made available, within each assigned area:

(a) The fixed installations barracks, houses, etc.

(b) Billets buildings available in nearby communities or villages.

(c) Cantonments either in nature of tent camps, which can easily be erected, or by temporary construction of materials locally available.

In general, the units of the various organizations will be assigned to their respective areas by the Air Base Commander in the most expeditious and economical manner.

(2) Requirements of Incoming Units. All units will take their normal allowance of tentage and camp equipment to the assigned areas, regardless of whether they may be assigned to any one of the above types of areas.

(3) Stock on Hand. In each bivouac area there will be sufficient stock on hand for replacement of tentage in hands of troops. (For stockage, see paragraph b. (3).

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(4) Layout of Bivouac Area.

(a) Security. It will be the responsibility of each Air Base Commander to have the units within the bivouac area so dispersed or concealed, and placed at sufficient distance from the target area, that personnel and supplies will have proper protection.

(b) In assigning personnel to tent camps or cantonment and billets, consideration should be given to the distance which the operating personnel would be required to travel to and from assigned tasks. Distance should be reduced as much as possible and still maintain safety from bombardment.

h. Supply Lines:

(1) Railroads. For general planning and discussion of this problem, due to geological reasons, the operations area is divided into two sectors:

(a) The Western Sector--That Area Lying Generally West of the Sierra-Cascade Range. This area has numerous feeder lines from the south, east and north. Due to its proximity to the Coast and the nature of the terrain, the main lines running north and south would be subjected to tremendous bombing operations. Due to importance of supplying troops in this area, it would seem vital to keep the lines open with sufficient repair crews. However, motor roads within this area are capable of keeping the tactical troops supplied until the situation requires evacuation, or until rail repairs are made. Unless the lines could be kept open from the south, the troops in the Oregon sector would necessarily have to be evacuated. The troops to the north would be in a better position to get replacement of supplies through the mountainous passes from the east, since the rail net is over a wider area and not as restricted as is the case of those in the south portion. There are suitable sidings for the detraining of troops and the storage of military impediments. Siding capacities for all stations in each area will be furnished each Air Force Commanding General. Sufficient rolling stock is available for all intended operations.

(b) The Eastern Sector--That Area Lying Generally East of the Sierra-Cascade Range. This area has feeder lines from the southwest, south, southeast and north, as well as rail connections toward the west. Strategically, this sector is well supplied with railroads as augmented by the motor-road nets to adequately carry on the required supply mission. There are suitable sidings for the detraining of troops and the storage of military supplies, as well as connections between the main sources of supply with the various sub-depots and distributing points. Sufficient rolling stock is available in this area, and a reserve stock is readily accessible from the rear.

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(2) Motor Roads. The situation as pertains to the roads now in the western sector is much the same as for the rail nets in that the roads in the Oregon region are comparatively near to the Coast, and will probably be subjected to repeated bombings. However, they are hard surfaced between all strategic points and allow quick movement of supplies to points needed both from the south and from the north. The roads to the east are over steep grades and winding courses, hence movement in this direction would be more or less restricted. Roads in the north portion of the sector are located for greater ease of maneuver and travel to the north and south, but have, more or less, the same problem of steep grades and winding courses that the east-west roads have in the Oregon sector.

(3) Road Nets in the Eastern Sector. These are limited in the southern portion of the area to a few main lines. The northern portion has several good main lines within the area. All installations in the supply chains are connected with hard-paved roads and are considered to be adequate for the situation.

i. Clothing:

(1) Requirement. In general, clothing will be supplied troops at stations in accordance with seasonal conditions. For the purpose of this problem, wool is prescribed for all personnel engaged in the combat zone in amounts prescribed by Table of Basic Allowances.

(2) Immediately upon orders for a concentration or operation, Air Force Commanders will make demands upon the Quartermaster depots through Air Force Combat Command for stockage of clothing to be made immediately available at designated depots in operation zone. Sufficient stocks will be maintained at each air base depot and sub-air base depot for normal exchanges and replacements for all troops stationed within the area.

j. Concentration of Troops:

(1) All units of the Second Air Force move into the assigned bases or sub-bases using organizational motor vehicles and air transport as directed by higher authority.

(2) All units of the Fourth Air Force to move into assigned sector using rail transportation, motor and air, as may be directed by the Commanding General of the Fourth Air Force so as to arrive at assigned bases and sub-bases as directed by higher authority. Detraining points are designated at BOISE, KLAMATH FALLS, MEDFORD, ROSEBURG, EUGENE, REDMOND.

(3) All units of the Third Air Force to move into the assigned sector using rail and air as directed by the Commanding General of the Third Air Force so as to arrive at assigned bases and sub-bases at a time as may be directed by higher authority. Detraining points available at BAKER, PENDLETON, YAKIMA, WALLA WALLA, BOARDMAN, THE DALLES, PORTLAND and SALEM.

(4) All units of the First Air Force to arrive in the assigned area after the completion of all rail movements of the Third and Fourth Air Force, and as directed by higher authority. Detraining points available

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at SALT LAKE CITY, OGDEN, LOGAN, WENDOVER, POCATELLO, BURLEY AND GOODING.

NOTE: The Commanding Generals concerned will make the necessary requests on the rail traffic manager of the War Department for routing and coordination of their respective train movements within the combat areas, as well as travel to the assigned areas of each Air Force.

5. MEDICAL CORPS

a. General: The Medical Department is responsible for the hospitalization, evacuation, and medical supply of the Air Force Combat Command. Provision is made in this plan for the hospitalization of slightly less than 9% of the total strength of the Command. The daily non-effective rate from disease should not exceed 3%, nor should the casualty rate exceed 4%. The total strength of the combined Air Forces is fixed in round numbers of 80,000 men. A total of 6979 hospital beds have been provided, distributed among the four Air Forces, or 8.7%. A reserve of an additional thousand beds for emergency use is held in readiness at Boise, Idaho (Evacuation Hospital one (1): 750 beds; Surgical Hospital one (1): 250 beds) for movement forward should they be needed. Evacuation within the Air Force areas is to be by surface ambulance principally, although rail transportation will be utilized if the situation demands. Air transport of patients is not contemplated to any appreciable extent. Evacuation to Zone of the Interior Hospitals will be by rail, using both hospital trains and ordinary passenger trains as required. Medical supplies are to be stocked at the OGDEN DEPOT, shipped by rail to each Air Force Medical Supply Section, and distributed throughout the Air Force by that unit with its own trucks and by returning ambulances. This plan provides for medical supplies for 50 days for each Air Force Aid Station. The OGDEN DEPOT will stock replacements for expendable supplies for the fixed hospitals at the rate of one freight carload per month for each 200-bed hospital.

b. Hospitalization: Existing Army hospital facilities in the concentration area will be considerably below those required to meet the needs of the entire Air Force Combat Command. Army hospitals at the various posts and stations are planned to meet the needs of the local garrisons. Any considerable influx of troops above the normal garrison strength will place a burden on these facilities which they are not prepared to meet, and therefore supplementary hospitalization measures must be taken. In any concentration of troops such as is here contemplated, considerable dispersion of units is demanded by modern tactical and other considerations so that many units must of necessity be located in remote communities with few hospitals and these are neither designed for nor capable of meeting more than the local civilian needs. The Air Force does not contain within itself any facilities for the care of its own sick or wounded except that provided by Aid Stations. There is in the Air Force no Medical Department unit similar or comparable to the Hospital Station (field hospital) of the Infantry Division or the Evacuation Hospital of the Field Army. In view of these facts, the plan for hospitalization for this concentration provides for:

(1) The temporary expansion of existing hospitals at established Air Bases.

0258

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(2) The temporary expansion of existing hospitals at established Army Posts in the concentration area.

(3) The employment to the fullest extent of Veterans' Bureau and civilian hospitals.

(4) The use of Field Army mobile medical units (hospital stations, surgical hospitals, evacuation hospitals) when indicated by the troop concentration and the non-availability of fixed military hospitals.

The hospitals existing at established air bases and military posts can be readily expanded to the limit of messing facilities by the use of barracks adjacent to the hospitals as wards. It is estimated that by the use of this type of wards the number of patients that can be cared for at each military hospital can be readily expanded 100%. It is to be noted that current regulations require each hospital to maintain sufficient supplies on hand for one year. It can therefore safely be assumed that sufficient supplies are on hand for double the normal number of hospital beds for three months (except in case of newly constructed air base hospitals which have on hand only sufficient medical supplies for their rated number of beds for three months).

Similarly it can be accepted that civilian hospitals can be readily expanded by the use of porches, corridors, and the placing of additional beds in private rooms. Unless there is a forced evacuation of the civilian population from the threatened points, the number of civilian casualties from enemy action would preclude the use by the Armed Forces of entire civilian hospitals in that vicinity. It is, therefore, believed inadvisable to depend upon the civilian hospitals for the Armed Forces in the large coastal cities in excess of 20% of their bed capacity. This objection does not hold, however, for those cities lying east of the Cascades and the use of expanded civilian hospitals up to 50% of their bed capacity may be depended upon. No extensive use of Field Army mobile medical units is provided for as the use of the expanded hospitals as contemplated above will be sufficient for ordinary hospitalization needs. As a supplementary reserve for emergencies, certain Field Army mobile hospital units will be spotted at designated points. The Commanding General of the Fourth Army will be requested to release these units to the Commanding General of the Air Force Combat Command; these units to be kept entrucked or entrained, and to be moved and set up as the developing hospital situation requires. Their location of readiness is indicated on the evacuation chart attached.

The minimum hospital beds provided should be not less than 6% of the troop strength. Of this number 3% should be available in the immediate area of the troops or within easy ambulance distance. This number of beds should be sufficient to care for the acute gastro-intestinal upsets, respiratory infections, and injuries particularly apt to be increased above the normal because of climatic and dietary changes, fatigue, etc. Hospitalization for acute temporary disorders and minor injuries within the unit area will relieve the evacuation problem and will facilitate return of the sick and injured to their commands for duty on recovery. This plan, as indicated in paragraph 5. a., provides beds for about 9% of the troop strength, exclusive of the General Hospital at Ogden.

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A list of the military, Veterans' Bureau, and civilian hospitals adjacent to unit encampment area of each Air Force is appended.

c. Evacuation: Table of Organization 8-400 provides for two field ambulances for each squadron and two for each group headquarters. A total of eight field ambulances will therefore be available in each combat group. To these there are to be added two for each air base group and one for wing headquarters, or a total of 21 for each two group wings. This number should suffice. No great reliance should be placed on evacuation by air as it is very likely that the tactical situation will prohibit any diversion of combat planes for this purpose. Transport planes returning empty to supply dumps and depots should be used to capacity for transporting patients whose condition demands immediate and rapid transport to well-equipped large hospitals. For the evacuation of large numbers of sick and wounded from the combat area, the use of hospital trains is recommended and it is advised that a certain number of these trains be spotted at designated points and released by the Army Commander to the control of the Commanding General of the Air Force Combat Command. The location at which these trains are to be held in readiness is designated on the accompanying evacuation chart. Patients thus evacuated will be transported to an Army General Hospital as indicated on the aforementioned chart.

d. Supply:

(1) The system of Medical Supply for all four Air Forces closely parallels the normal supply channels. The installation of a General Depot at OGDEN, UTAH, is provided for. Each Air Force has as a component a Medical Supply Section of two (2) officers and nineteen (19) enlisted men, with total truck transportation of 3½ tons. It is planned for the Depot to ship medical supplies by rail on request to each Air Force Medical Supply Section, except that for the First Air Force, which has been located at OGDEN. This unit can act at OGDEN as the shipping agency from the depot to the First Air Force by truck, thereby eliminating any Air Corps Medical Supply Section storage.

(2) The Supply Plan contemplates the following:

(a) Each medical unit will arrive in the concentration area with sufficient supplies for 10 days. This is contained in the equipment standardized for the Squadron, Group, and other Aid Stations.

(b) A further supply for an additional 10 days is to be with each Air Force Medical Supply Section on its arrival in the concentration area. (List attached)

(c) It is proposed that the OGDEN DEPOT stock replacement for 30 days for each Air Force, and that the credit thus established be shipped by rail to the Air Force Medical Supply Section in 10-day units on request. (List attached)

(d) The distribution from the Medical Supply Section to the forward echelons will parallel the Air Corps Supply distributing system. Medical supplies are for the most part not heavy

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or bulky and can be delivered to the forward echelons by truck, and in emergency probably by transport plane.

(e) Fixed and Mobile Hospitals. It is estimated that approximately one standard freight carload of expendable medical items, and miscellaneous non-expendable items will be required per month for each fixed Air Base Hospital and for each Mobile Hospital set up and in operation. This represents about one carload for each 200 patients. Shipments are to be by rail direct from the Depot (OGDEN) on requisition. The car shipments would therefore be as follows per month:

First Air Force	2
Second Air Force	4
Third Air Force	2
Fourth Air Force	3
TOTAL	11

(f) Hospital Expansion Requirements. The hospitalization plan for the four Air Forces in the Pacific Northwest will require the expansion of all existing Air Base Hospitals. The necessary expansion can be effected rapidly by utilizing existing barracks adjacent to the hospitals for shelter. Additional equipment required consists of the present standard equipment for a 100-bed hospital (Medical Department Supply Catalogue No. 97-35) less non-expendable X-ray, laboratory, dental, surgical, and kitchen items which are already on hand. This equipment should be assembled in 100-bed units, packed and prepared for shipment. It is proposed to expand hospitals as follows:

	Present Capacity	Expansion Capacity
Fort George Wright	100	200
McChord Field	50	200
Everett Air Base	100	200
Portland Air Base	100	200
Pendleton Air Base	100	350
Boise Air Base	100	200

The additional Medical Department Personnel required for expanded hospitals will be:

Location	Officers	Enlisted Men	Nurses
Fort George Wright	10	100	10
McChord Field	15	100	15
Everett Air Base	10	100	10
Portland Air Base	10	100	10
Pendleton Air Base	10	150	15
Boise Air Base	10	100	10
TOTAL	65	650	70

No estimate has been made for a General Hospital in the Area, as

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this pertains more to the Army than to the Air Force Combat Command. Also, no account has been taken in this study for the supply of medical necessities for the civilian hospitals receiving military patients. It is assumed that these hospitals have a substantial supply of needed items on hand and that replenishments will be available from wholesale or other civilian supply sources.

(5) The following is an estimate of the weight of stocks carried by the designated supply units:

CLASS IV

Air Force Medical Supply Section (4)
10-day stock - estimated weight: 20,000
Medical Supply Depot
30-day replacements - estimated weight: 60,000

CLASS III

Fuel and Lubricants. For Medical Motor Transportation. To be supplied by Q.M.

10-day Supply:

Gasoline	27150 gal.
Oil	1080 gal.
Grease	962 lbs.
Kerosene	200 gal.

30-day Supply:

Gasoline	81450 gal.
Oil	3240 gal.
Grease	2886 lbs.
Kerosene	600 gal.

e. Recapitulation:

(1) Hospitalization.

Air Force	Troop Strength	Beds Required	Beds present and projected
First Air Force	16672	832	2103
Second Air Force	29813	1488	1411
Third Air Force	25135	1256	2390
Fourth Air Force	19155	957	1075

Under the column above headed "Beds present and projected" the excess over the beds required is due to:

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(a) Uneven distribution of troops with respect to existing civilian and military hospitals.

(b) The existence of the Barnes General Hospital.

(c) The General Hospital which it is contemplated will be erected at Ogden, Utah.

This excess in hospital beds will undoubtedly be compensated for by the requirements of the Ground Arms on the General Hospitals.

(2) List of hospitals available.

U. S. GOVERNMENT:

Hospital	Location	Number of Beds
	First Air Force	
Army General Hospital	Ogden, Utah	**1500
Station Hospital	Fort Douglas, Utah	* 250
Hospital Station	Burley, Idaho	** 250
U.S. Veterans Bureau	Salt Lake City, Utah	104
	Second Air Force	
Station Hospital	Fort Lewis, Wash.	1500
" "	McChord Field, Wash.	* 150
" "	Fort Lawton, Wash.	20
" "	Everett Air Base, Wash.	* 200
" "	Fort Worden, Wash.	* 60
" "	Fort George Wright, Wash.	* 200
U.S. Navy Hospital	Bremerton, Wash.	308
U.S..Veterans Facility	Ft.Harrison, Helena, Mont.	154
	Third Air Force	
Barnes General Hospital	Vancouver, Wash.	1000
Station Hospital	Portland Air Base	* 200
" "	Vancouver Barracks, Wash.	132
" "	Pendleton Air Base, Ore.	* 200
U.S. Veterans Bureau	Portland, Oregon	406
U.S. Veterans Bureau	Walla Walla, Wash.	421
	Fourth Air Force	
Station Hospital	Boise, Idaho	* 200
U.S. Veterans Bureau	Boise, Idaho	203
(Mental)	Roseburg, Oregon	566

*Expanded.
**Obtain from Army.

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CONSOLIDATED LIST OF HOSPITALS

CIVILIAN:

First Air Force

Location		Number of Beds
Gooding, Idaho	(1)	16
Twin Falls, Idaho	(1)	75
Burley, Idaho	(1)	16
Pocatello, Idaho	(2)	115
Logan, Utah	(2)	112
Ogden, Utah	(1)	188
Salt Lake City	(4)	967

Second Air Force

Bellingham, Wash.	(2)	180
Everett, Wash.	(1)	144
Seattle, Wash.	(3)	996
Tacoma, Wash.	(2)	447
Wenatchee, Wash.	(2)	110
Spokane, Wash.	(3)	645
Olympia, Wash.	(1)	100
Aberdeen, Wash.	(1)	60
Port Angeles, Wash.	(2)	137
Ellensburg, Wash.	(2)	40
Butte, Montana	(3)	377
Helena, Montana	(2)	139
Missoula, Montana	(1)	102

Third Air Force

Astoria, Oregon	(2)	176
Chehalis, Wash.	(1)	23
Vancouver, Wash.	(3)	163
Portland, Oregon	(4)	1082
Salem, Oregon	(1)	100
The Dalles, Ore.	(2)	97
Yakima, Wash.	(2)	312
Pendleton, Ore.	(1)	70
Walla Walla, Wash.	(2)	135
LaGrande, Ore.	(1)	45
Baker, Oregon	(1)	100

Fourth Air Force

Eugene, Oregon	(2)	160
Roseburg, Oregon	(1)	33
Medford, Oregon	(1)	75
Klamath Falls, Ore.	(2)	90
Ontario, Ore.	(1)	35
Boise, Idaho	(2)	254

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(3) Projected Expansion.

Hospital	Location	Number of Beds	Addl. Beds Required
Station Hospital	Ft. Geo. Wright, Wn.	100	100
Station Hospital	McChord Field, Wash.	50	150
Station Hospital	Everett Air Base, Wn.	100	100
Station Hospital	Portland Air Base, Ore.	100	100
Station Hospital	Pendleton Air Base, Ore.	100	250
Station Hospital	Boise Air Base, Idaho	100	100

(4) Installation of Mobile Hospital Units Required.

	Location	Unit
Second Air Force	Ellensburg, Wash.	Hospital Station
Third Air Force	Roseburg, Oregon	Hospital Station
Fourth Air Force	Redford, Oregon	Hospital Station
First Air Force	Burley, Idaho	Hospital Station

(5) Reserve of Fixed and Mobile Medical Department Units.

Unit	Location	Remarks
General Hospital (1)	Ogden, Utah	For reception of evacuees from all 4 Air Force Areas.
Evacuation Hosp. (1)	Boise, Idaho	Obtain from Army and hold in readiness.
Surgical Hosp. (1)	Boise, Idaho	Hold in readiness.
Hospital Trains (3)	Two (2) at Boise One (1) at Ogden	Hold in readiness.
Army Medical Depot (1)	Ogden, Utah	For supply of all 4 Air Forces.

(6) Evacuation.

(a) Ambulances. The field ambulances with the units and the administrative ambulances at established Air Bases and Posts in the area are sufficient.

(b) Airplane. Air transport of selected cases is advised if the military situation permits the use of transport planes for this purpose. The air evacuation of patients will not be necessary on a large scale so far as can be foreseen.

(c) Hospital Trains. Three hospital trains are to be obtained, two (2) to be held in readiness at Boise and one (1) at Ogden for evacuating any area to the General Hospital at Ogden if necessary.

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(7) Supply.

(a) With unit. Stock of medical supplies sufficient for ten days.

(b) With A. F. Medical Supply Section. Replacements for ten days for 1. (List attached)

(c) In Depot (OGDEN). Supplies for each Air Force for thirty days. (List attached)

(d) Beds and bedding required to expand existing hospitals are to be procured from local Quartermaster. Existing barracks are to be used for additional shelter. Medical supplies to be stored at OGDEN DEPOT for shipment on order. One item 97315 M D Catalogue, expandable items only. Hospitals to be expanded as follows:

Fort George Wright, Washington, by 100 beds
McChord Field, Washington, by 100 beds
Everett, Washington, by 100 beds
Pendleton, Oregon, by 250 beds
Portland, Oregon, by 100 beds
Boise, Idaho, by 100 beds

(e) Class 3 Fuel and Oil for Medical Department Transportation. To be supplied by Quartermaster on following 10-day basis:

	Gas	Oil	Grease	Kerosene (50 Gal drum)
Second Air Force	6060(gal)	240(gal)	215(lb)	1
Third Air Force	7515 "	300 "	266 "	1
Fourth Air Force	6060 "	240 "	215 "	1
First Air Force	7515 "	300 "	266 "	1
TOTAL	27150	1080	962	4

(8) Rehabilitation. Taking into account the experience of the combatants in the present war and particularly that of the R.A.F., some provisions must be made for the rehabilitation of airmen affected by operational fatigue. The number of cases that will develop and their severity will vary with the character and intensity of the operations. Reports indicate that a high percentage of airmen require a prolonged rest after about 250 hours of combat flying. This is readily understandable, when the physical and nerve strain of flying long hours in cold and darkness at high altitudes, of the nervous energy expended in dog fights, ground strafing, and bombing operations under heavy fire are considered. It is contemplated that rest and recreational camps be established. These camps should provide opportunities for athletic diversions and amusements. The taking over of hotels at such national playgrounds as Estes Park and Grand Lake, Colorado, would seem to be ideal for the purpose. In winter, the Tucson, Arizona area is suitable. These resorts have golf courses, tennis courts, lakes and streams for

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fishing, trails for horseback riding, and are far enough removed from the combat area to insure absolute absence from the war atmosphere. The altitude is not considered an objection.

6. ORDNANCE -- (See special Ordnance Report attached.)

7. CHEMICAL WARFARE SERVICE

a. General: The problem presented is to adapt the Air Force chemical units which are organized and equipped to meet the needs of the Air Forces for chemical supply and service under so-called normal operating conditions, to the special situation obtaining herein. The movement of the First, Third and Fourth Air Forces into the Second Air Force area for immediate operation places the burden, for initial supply, of all items of chemical warfare material and equipment upon the organic chemical units of the Second Air Force. At first glance this would appear to be relatively simple of solution, particularly in view of the small number of supply items (less than 20) which must be provided. However, not only must the air base and sub-air base supply points be adequately stocked and the necessary supply personnel assigned for the initial 10-day operating period, but supply must be further decentralized to many exposed operating airdromes.

Since the employment of toxic chemicals by our own forces is not contemplated in the initial phase, the major function of the chemical warfare service will be defensive. However, the possible use by our forces of toxic chemicals in retaliation requires that adequate stocks of such materials be provided in the rear area chemical depots of the various air forces.

It will be necessary to spot greater quantities of all chemical defensive materials at exposed operating airdromes than at such points further removed from the coast. These quantities must be determined by a sliding scale of supply from west to east. Priorities on deliveries must also be established. The above discussion has been limited generally to the problem of the initial 10-day operating period. However, plans for indefinite further operation must be thoroughly considered from a supply standpoint.

As an example of the magnitude of the initial 10-day supply problem alone, attention is invited to the fact that it will require 140 freight cars moving an average distance of 2850 miles from point of origin to 26 separate operating areas. A large percentage of the total tonnage will be decontaminating materials.

b. Chemical Warfare Troop Organization--Air Force Chemical Service and Supply: One chemical staff section consisting of two officers and five men and one chemical company, service (aviation) are assigned to each Air Force. The staff section performs Air Force special staff duties and is an integral part of each Air Force headquarters. The strength of the chemical company varies for each Air Force depending upon the number and type of Air Force groups and squadrons assigned. It is organized, trained and equipped to perform the special chemical service and supply functions required by the Air Force in a theatre of operation either within or beyond the continental limits of the United States. For the concentration of the four

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Air Forces in the Second Air Force area, the chemical staff sections are located at theatre of operations headquarters of their respective Air Force. The Chemical Companies, Service (Aviation) are located in general within their respective Air Force service area. However, each company is subdivided into detachments which are assigned to stations in accordance with the general plan of service and supply (see "Disposition of field forces, First, Second, Third and Fourth Air Forces"). In this connection, attention is invited to the fact that attachments are made to parent Air Force units prior to movement into the theatre of operations and the detachments move with their units regardless of the location of the operating airdrome. Thus the 31st Pursuit Group (I), a unit of the First Air Force whose operating airdromes are located at Aberdeen, Washington (situated within the Second Air Force area), will be served by detachments of the First Chemical Company, Service (Avn), a service unit of the First Air Force. In all such instances chemical detachments with Air Force units operating in the service area of an Air Force other than their own will come under the general supervision and control of the chemical company assigned that area during the period of such operation.

The following services will be performed by detachments of the four chemical companies for the several Air Forces:

(1) Chemical Laboratory Service. This service is provided by the laboratory section of company headquarters at Air Force headquarters. The principal duties consist of chemical determination of new agents, the distribution of such information as applies either through Air Force G-2 channels to operating units or directly to zone of interior research laboratory at Edgewood Arsenal, Maryland, for further investigation and development of new protective equipment and materials as may be required.

(2) Chemical Supply Service. This service is provided for first by the operation of Air Force chemical depots for Class V materials for direct supply to air bases, sub-air bases and DP's. These supplies are not routed through air base area supply channels but go directly to RP's and unit DP's. Necessary transportation will be supplied by the Quartermaster, using either rail or road or both; secondly, by the operation of Chemical Supply Sections at each air base for Class II supplies, these supplies will move via normal air base area supply channels; and finally, by the operation of Chemical DP Sections at each operating airdrome. These sections receipt for and issue to operating units, Class II chemical supplies and decontaminating materials.

(3) Chemical Ammunition Service. This service consists of the storing and loading of bulk chemical ammunition at suitably located DP's and the delivery of filled spray tanks to airplane stations on operating airdromes. This service is provided for light bombardment groups and light reconnaissance squadrons only, since the employment of bulk chemicals by other types of aircraft is not contemplated. A chemical platoon (a unit of the Chemical Company, Service (Avn)) is provided for each light bombardment group and is organized, trained and equipped to provide such service for each squadron regardless of location. In addition, the chemical platoon is charged with chemical DP Section functions for light bombardment units which they serve for Class II chemical supplies and decontaminating materials.

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Note: Chemical bombs, although filled at chemical warfare arsenals in the zone of interior, are stored and issued in the theatre of operation by the Ordnance Department. Their employment in the initial operation period is not contemplated.

(4) Chemical Decontaminating and Anti-incendiary Service. This service is provided for by the operation of special power-driven decontaminating apparatuses and the technical supervision of all decontaminating and anti-incendiary operations as may be required at each operating airdrome. This service is provided for by the assignment of one or more chemical decontaminating detachments (units of the Chemical Company, Service (Avn)) at each operating airdrome. The personnel is trained and equipped to render technical supervision only for all large-scale decontaminating operations. The great amount of manual labor involved requires that squads of trained Air Corps and other service personnel must be available to perform the work using organized decontaminating equipment issued to units for the purpose. "Spot" decontaminating operations may in some instances be accomplished by chemical decontamination detachments without aid. Anti-incendiary service is performed in a manner similar to that outlined above for decontaminating service.

c. Chemical Equipment: All Air Force and service units will move into their operating areas completely equipped with all items of chemical equipment and materials as authorized in tables of basic allowances. Adequate provision has been made for the replacement of all such equipment and material through normal and special supply channels. Chemical decontaminating and DP units will, immediately upon arrival at operating airdromes, begin a thorough survey of local civilian facilities with a view to securing all possible equipment and material that may be useful in the performance of their decontaminating and anti-incendiary defense missions. Such material may include fire-fighting apparatus of all kinds, street sprinklers, sand, tank-trucks for water hauling, etc.

d. Chemical Supplies--Initial 10-Day Operating Period:

(See Chemical Warfare Supply Tabulations in Air Force folders.)

e. Depots: Chemical depots for Class V supplies will be established in each Air Force service area. These installations are essential in the almost certain event that operations are extended beyond the initial period. Storage at such depots will depend upon the requirements as determined by the initial operating period. Depots will be located at the following points (see attached Air Force service area charts):

First Air Force -- Ogden
Second Air Force -- Missoula
Third Air Force -- Pendleton
Fourth Air Force -- Boise

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SECTION III

COMMUNICATIONS

1. GENERAL:

a. Efficient Rapid Communication: Communications of Air Force organizations are in general the same as for ground organizations except that much greater emphasis is placed on speed and accuracy because fleeting targets require immediate instantaneous action.

b. Types of Communications: Telephone and telegraph (teletypewriter) are the basic means of communication of all air units while not in flight, and radio-telephone, and radio-telegraph are the basic means of communication for units in flight. It is quite common to think of communications of air units as synonymous with radio communications, but radio communications represent the secondary, or emergency means, between the ground units of the air forces.

c. Types of Nets: One important distinction should be made between the Tactical and Administrative communications nets. The former, as its name implies, includes all tactical organizations, within the Air Forces in a tactical and intelligence net. Experience has shown that the tactical and intelligence net must be divorced from the administrative net. Accordingly, a purely administrative net is established to relieve the load on the tactical net by the handling of all traffic pertaining to supply. Sub-air bases and distributing points are connected to the air bases in this administrative net. An efficient administrative communications net facilitates supply.

d. Mobility: All communications echelons (with the exception of the fixed communications echelons of the Interceptor Commands) must be highly mobile in order to insure uninterrupted service during a rapidly changing situation. The necessity for mobility in the communication echelons cannot be over stressed. This is especially true of communication echelons employed with light and medium bombardment units. It is highly probable that if an enemy beach landing is established, the bombardment units would be called upon for direct or close support of the ground forces, in which event message centers will have to be established in the forward areas to accompany advanced headquarters placed thereat. Message centers employed in the extreme forward part of the combat zone must be equipped for short periods of self-sustained operations in the event that they are separated from units charged with their protection, messing, and housing.

e. Interceptor Commands: The Second Interceptor Command communication setup will be considered as permanent and its present commercial facilities will remain unchanged. The Interceptor Commands of the other Air Forces will be used to augment the Second Interceptor Command in its present location. The pursuit wings attached to the various Interceptor Commands, however, will be provided communication within their organizations and to their respective Air Force headquarters.

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2. REQUIREMENTS

a. Commercial Facilities: Since a large number of telephone and teletype circuits are needed over and above those now available to the Second Air Force, commercial communication companies will be called upon to furnish the required facilities. The American Telephone & Telegraph Company through its local companies is preparing a plan to provide all the circuits considered necessary, as stated within the following paragraphs, on specific circuits required. The number of these circuits for each headquarters has been determined as the minimum necessary to take care of maximum traffic rather than average traffic in order that the communications system will not break down during "peak-load" periods. In certain areas it will be necessary to prescribe roundabout routings, and in some instances construction will be required. In this connection, the American Telephone & Telegraph through its local affiliates is preparing a detailed plan covering all of these requisites, making note of the construction necessary and also preparing a complete list of the costs involved. This plan will be filed with Second Air Force Headquarters.

b. Tactical and Intelligence Net: The Air Force Combat Command should be connected with the four Air Forces by not fewer than four reliable telephone circuits and three telegraph circuits. The telegraph circuits will be connected by both teletypewriter and telegraph instruments. Provision will also be made to use telephone lines for telegraph by Simplex circuits so as to reduce the number of circuits required. The connections between air force and wing headquarters will be not fewer than three reliable telephone circuits and two telegraph circuits, to be imposed on the telephone circuits by the Simplex method. The connections between wing and group headquarters will be two-telephone and one teletype circuits, but greater use should be made of the teletype circuit. Each squadron should be connected to group headquarters by at least two telephones, and when practicable, one teletypewriter circuit. Communications within the Air Force Combat Command Headquarters, Air Force Headquarters, and Wing Headquarters will employ the telephone primarily, and these facilities will be installed by the Signal Corps units attached to those headquarters. It is further considered necessary that tie lines be installed between adjacent headquarters to furnish additional routings in case of emergency. In some instances, these indirect routes (tie lines) may temporarily have to be considered as direct routings until temporary construction is completed (permitting physically direct routings). There are many areas in the Pacific Northwest where secondary routes will necessarily be used, and at certain points construction will probably be required.

c. Administrative Net: Each Air Base will have two telephone and one teletype circuit to each Air Force headquarters. Each air base will in turn be connected with the sub-air base by two telephone and one teletype circuit. Distributing Points should have a telephone line to the sub-air base or air base to which it is attached.

d. Radio Nets: Radio nets should parallel both the Tactical and Administrative wire nets on a 24-hour operation basis, but in the interest of secrecy and to avoid congestion will be used only as an emergency means. In short, air ground radio communications will have priority over point-to-point radio.

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e. Other Means of Communication: Airplanes will be employed to a considerable extent for messenger service, and motorcycles and automobiles will be used extensively for short-distance service of this type. These services will be utilized so far as is possible for routine reports wherein speed in delivery is not important. Messenger service is most effective when operated on a regular schedule.

f. Instrument-Landing Facilities: Provisions for instrument landing services at airdromes designated will be made by the Air Force concerned, based on the availability of instrument-landing equipment.

g. Weather and Airport Information Circuits: The Weather Circuit (Circuit C) and Air Information Circuit (under the CAA at present) will be taken over and circuits added to reach all tactical groups.

h. Communication Equipment. It is required that all Signal Corps and communication equipment held by Air Force organizations be transported to the concentration area by the organizations holding the equipment. This is necessary because of the present lack of adequate Signal Depot supply stocks. Teletypewriters required in excess of those on hand by units at their home bases can be obtained locally, in the area of the Second Air Force, by the telephone companies through withdrawals from commercial use. Further reference to Communication Equipment is found under "Signal Corps Supply."

3. ORGANIZATION

a. Net Organization: As mentioned in paragraph 1., General, there will be primarily two nets--the tactical net and the administrative net. Due to the distances and equipment involved, no more than one radio net under each heading will be necessary. There will be no need for subdivisions of any one radio net since the distances are relatively short within each Air Force. This pertains to the radio nets, which will parallel the telephone and teletypewriter net. It will follow the Command channel from the Air Force Combat Command to the Air Forces, to the wings, to the groups, and to the squadrons. The administrative net includes the air force, with lines to the air base, to the sub-air base, and finally to the distributing point. A diagram presenting this information on each type of net is attached hereto.

b. Call Signs and Frequencies: Radio Call Signs and Radio Frequencies under GHQ Memorandum 100-12 and 100-13 will be adhered to. Teletype Call Signs under GHQ Memorandum 100-8 will be used.

c. Personnel: The above mentioned radio nets function with the following personnel: All radio stations within the Second Air Force Tactical and Radio Net will be operated by Air Force communications personnel, but at the wing stations will be under the guidance of the wing signal officer, and at the Air Force under the guidance of the Air Force signal officer. The administrative net will be handled by Signal Corps personnel, with the Signal Company Aviation at Air Force Headquarters and the Signal Platoon air base with the air base groups responsible.

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4. DISPOSITION OF SIGNAL SERVICE UNITS

a. General Disposition: Reference is made to the station lists indicating the location of the various Signal Corps Units involved. The locations will be explained in the following paragraphs.

b. Signal Company Aviation: This organization will be located at the Air Force Headquarters to which it is assigned (and the AFCC Signal Company Aviation with that Headquarters) and normally no detachments will be made except for advance echelons.

c. Signal Company Maintenance: This organization will have its headquarters and one maintenance platoon at the Air Force Headquarters to which it is assigned. The other three platoons will be located at the various wing headquarters so that they may be dispatched to such points where emergency construction is immediately needed. Signal construction service will be necessarily augmented by commercial telephone organizations in this area due to the amount of construction that will be necessary. Telephone companies have been informed of this and will be ready to assist when called upon.

d. Signal Company Air Wing: This organization will be located at the Wing Headquarters to which it is assigned.

e. Signal Company, Depot: When established, the Signal Company Depot for each Air Force will be located at Air Force Headquarters. Further reference to this organization is made under Signal Corps Supply.

f. Signal Platoon, Air Base: The Signal Platoons will be located at the air base groups to which they are assigned and detachments therefrom sent to the sub-air bases, as locally determined necessary.

5. SIGNAL CORPS SUPPLY

a. Plan of Supply: Supply of Signal Corps equipment will be handled within the Air Force by Signal Company Depot to air base, then sub-air base, and finally the distributing point.

b. Equipment on Hand: As heretofore stated, all units of the Air Force Combat Command will bring their Signal Corps equipment for both air and ground communication with them to the concentration area. Organizations will initially have enough Signal Corps supplies to carry them through the first ten-day phase of operation, and replenishments thereafter will be through normal supply channels by requisition on the air base.

c. Source of Supply: At the present time Signal Corps equipment is distributed to this area from the following points:

(1) Signal Section, Chicago Quartermaster Depot and the Chicago Signal Corps Procurement District.

(2) The San Francisco General Depot and the San Francisco Signal Corps Procurement District, Presidio of San Francisco. Supplies would normally be transported by rail, and emergency shipments would be made by air.

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d. Signal Company, Depot: While at the present time a Signal Company Depot has not been established for the Second Air Force or for the other Air Forces, it is considered necessary that these be formed for the Air Forces, from depot companies now operating under the various Armies. In this connection, the 202nd Signal Company Depot at Fort Lewis, Washington, would logically be called upon to furnish a cadre for the Second Air Force. These organizations, one of which would be at each Air Force, would be responsible for the supply of all Signal Corps equipment. They would supply the equipment to the air bases for distribution to sub-air bases and distributing points. The location of these advanced depots is placed at each Air Force Headquarters.

e. Flow of Supplies: Chicago (The Signal Section, Chicago Quartermaster Depot and the Chicago Signal Corps Procurement District) will be the point from which supplies issue to the various Air Forces. Chicago has direct rail access to the Air Force Service Area and is not vulnerable to enemy attack by way of the Pacific Coast. In the event of a withdrawal resulting from a successfully established enemy beachhead, the supply lines will be shortened instead of lengthened as in the case of San Francisco being used as a supply point. Therefore, the depots at San Francisco will only be called upon for emergency Signal Corps items.

SECTION IV

MISCELLANEOUS

1. MAPS AND CHARTS

a. General: Maps and charts of the theatre of operations will be required. Aeronautical charts of the concentration area, in addition to those brought into the area by units, should be provided to permit a one hundred (100%) percent replacement. Topographic maps of the various scales of the coastal region should be provided for use in planning operations and for direct and close-support operations with ground forces. Similarly, general, coast and harbor charts of the Pacific Coast and Hydrographic Charts, U. S. Navy, should be provided on the basis of an initial issue plus a one hundred (100%) percent replacement. All replacement maps and charts will be stocked at air bases or sub-air bases in such manner as to facilitate distribution.

(1) Aeronautical Charts, Initial Supply. Each unit will arrive in the concentration area with aeronautical charts (Sectional, Regional and Radio Direction Finding) of the area north of the 40° N. parallel, and west of 108° W. Meridian, in the following amounts: One (1) per airplane, plus twenty-five (25) percent extra.

(2) Aeronautical Charts, Replacement. Requisitions will be submitted by units through Base Air Corps Supply Officers to their respective Air Force Engineer Officer. The Engineer Officer, Second Air Force will

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requisition and stock maps of the coverage indicated in (1) above, at the points listed below in the quantities indicated.

First Air Force Area:	
Salt Lake Air Base	250 copies each
Second Air Force Area:	
Geiger Air Base	600 copies each
McChord Air Base	150 " "
Everett Air Base	150 " "
Third Air Force Area:	
Pendleton Air Base	500 copies each
Portland Air Base	400 " "
Fourth Air Force Area:	
Boise Air Base	600 copies each
Eugene Sub-Air Base	250 " "
TOTAL	2900 copies each

(3) Maps (Other Than Aeronautical). None will be required prior to the concentration. Upon arrival in their concentration areas, the Engineer Officer, Second Air Force, will furnish each Air Force Headquarters with such maps of the area North of the 40° N. parallel and west of the 108° W. Meridian, as are available, of the types and quantities shown in the table below. Replacement by units will be as for Aeronautical Charts. The Engineer Officer, Second Air Force, will stock maps of these classes and coverage at the points indicated and in the quantities shown in the following table:

	Small Scale 1:1,000,000	Intermediate Scale, Strategic, 1:500,000	Medium Scale 1:62,500	Large Scale as issued to ground troops	C&GS *	H.O.Navy Dept. **
Hq AFCC	50	30	50		50	50
Hq First AF	250	1000	2000	1000	2000	2000
Hq Second AF	150	520	1000	500	1000	1000
Hq Third Af	250	850	1750	1000	1750	1750
Hq Fourth AF	200	600	1200	600	1200	1200
Geiger AB	300	1000	2000	1000	2000	2000
McChord AB	100	200	500	200	500	500
Everett AB	100	200	500	200	500	500
Pendleton AB	100	500	1000	500	1000	1000
Portland AB	100	250	500	200	500	500
Boise AB	100	350	800	500	800	800
Eugene Sub-Air Base	100	250	300	200	300	300
Salt Lake City AB	100	250	400	200	400	400
	1900	6000	12000	6100	12000	12000

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Coast & Geodectic Survey Maps:

* Sheets Number --

5902	5984	6151	6377	6407
5932	6002	6153	6378	6412
5702	6004	6154	6380	6440
5895	6023	6155	6381	6443
5896	6058	6185	6382	6444
5902	6102	6195	6399	6447
5951	6112	6265	6403	6449
5952	6122	6300	6405	6450
5971	6146	6303	6406	6460
				6462
				7002

** Hydrographic Office, U. S. Navy Charts:

Sheets Number --

527	1427	1449	1453	1584
528	1430	1450	1454	1597
529	1432	1451	1455	1762
1006	1442	1452	1583	1767
				5365

2. CONTROL OF ROAD TRAFFIC

a. Within Air Bases or Other Air Establishments: Control of traffic, both military and civilian, within permanent or temporary air bases and other air establishments, is a responsibility of the local Commander. Personnel utilized for this function will be the minimum number required for effective control and will be so selected as not to interfere with operation, supply and maintenance of aircraft. Such personnel will habitually perform the dual function of traffic control and assistance in terrestrial protection against ground attack and sabotage. Local plans for protection will contemplate this dual function.

b. Roads: Control of traffic over roads and highways in the area occupied by the Air Force is a function of the Commander of all Arms within which the area lies. The Air Force Commander will coordinate plans for road movement of all Air Units with the Commander of all Arms and will make the necessary representations and recommendations for local control of traffic in the vicinity of air bases and other establishments of the Air Force. Acting within provisions of orders and instructions issued by the Commander of all Arms, Commanders of air bases and other air establishments will coordinate and control local traffic in the vicinity of their areas. Military traffic will have priority on all required roads. Control of any refugees on roads or within areas adjacent to air bases and other air establishments will be given special attention to the end that military traffic and operations are not interfered with, and that any necessary flow of refugees continue over routes designated by the Commander of all Arms in the area or, in the absence of such instructions, over routes designated by the local air base or other establishment Commander concerned. The use of

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civilian City and State Highway Police should be coordinated and utilized to the fullest extent.

3. SECURITY

a. Airdromes: Unit Commanders, upon arrival at their operating bases, will take immediate steps to secure their equipment, supplies, and personnel from the enemy. Due to the shortage of Engineer Troops, units must be prepared to protect the aircraft from hostile air attack by dispersion, construction of revetments and by camouflage, utilizing the available facilities. Efforts must be made to obtain from civilian agencies in the locality in which they are based the services of personnel, equipment and supplies that cannot be obtained from military sources, in carrying out the provision of their airdrome defense plans.

b. Unprotected Servicing Points: Since it is contemplated stocking certain commercial airdromes along the lines leading into the Air Force concentration areas with aviation fuel and oil to facilitate movements of units thereto, it is necessary to provide for the security of these servicing points from subversive acts by the enemy. It is believed that the defense of such commercial installations will be the responsibility of the Army Commander of the area in which the installations are located. Normally, a company of infantry will be sufficient to protect properly these servicing points. The services of the Federal Bureau of Investigation should be solicited in an attempt to pre-determine the direction of the subversive threat.

SECTION V

SPECIAL COMMENTS

1. In the formulation of a plan for the concentration of the entire Air Force Combat Command in the Second Air Force Area, several situations and conditions have been brought to light which are believed to be worthy of comment. These are:

a. Lack of Suitable Operating Airdromes: It was apparent from the first that a severe shortage existed in suitable operating airdromes in the concentration area. Sufficient airdromes are not available or in process of development to permit the efficient operation of all units of the Air Force Combat Command in the concentration area.

b. Inadequacy of Aircraft Servicing Facilities. It is difficult to realize the almost complete absence of adequate servicing facilities between the Mississippi River and the Pacific-Northwest. Some aviation fuel has been let on commercial contract at a few scattered airdromes throughout the area, but there is no systematic distribution of aviation fuel and oil at points along the probable routes of approach to the Second Air Force Area. The problem of aircraft servicing in the Second Air Force Area is not solved for the few airplanes now on hand in the Combat Units.

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c. Shortage of Engineer Troops: The number of Engineer Troops available to the Combat Command for the purpose of the concentration problem is inadequate to meet requirements placed upon them. Engineer Troops are of vital importance in the initial preparations of a combat zone for operations. This is especially true when operations are conducted at points where airdrome facilities are insufficient to permit proper dispersion. In such a situation, Engineer Troops will be employed to the limits of their capabilities in preparing airdromes in the forward area for the dispersion of aircraft thereon. It is recommended that at least a regiment of Engineers be assigned to each Air Force in the Combat Command.

d. Ordnance Servicing Troops: In operations initiated at long range from the shoreline where advance refilling points at or near the coast are necessary in order to extend bombardment range, a severe load is placed on the Ordnance Servicing Troops at the refilling bases. Ordnance Servicing Troops are assigned to an air base normally to service aircraft based thereat. If units are routed through an advance refueling point continuously, Ordnance Service is likely to break down unless the refueling base is reinforced bo other Servicing Units. The problem of Ordnance Servicing can be solved by either of the following methods:

(1) Increasing the mobility of Ordnance Servicing Units in the rear areas to permit them to move forward with Bombardment Units to the advance refilling points to supplement the Ordnance Service thereat.

(2) Assigning to each Air Force a reserve in Ordnance Servicing Units to be transported to those points where requirements are the heaviest.

Note: In the formulation of the Basic Plan, an attempt has been made to solve the problem of Ordnance Service by initially attaching certain Ordnance Units to the forward refueling points based upon probable plan of tactical operations.

e. Labor Troops: Quartermaster activities in the initial preparations of certain installations and facilities in a theatre of operations require the services of Labor Troops, which Troops are not available to an Air Force. Recommend that Labor Battalions be organized, and one battalion be attached to each Air Force to be used in Quartermaster activities in preparation for combat.

f. Commercial Motor Freight: The Basic Plan contemplates the use of commercial motor freight in supplementing transportation facilities. Commercial freight companies have been developed in this country in recent years to such an extent that they are able to contribute materially to the transportation needs of an Air Force. When such transportation involves the use of roads used by the Military, movement will be coordinated and controlled by the officer designated for traffic control.

g. Group Hospital: The existing medical setup for the Air Corps is such as to make the Air Force completely dependent on ground arms for hospitalization when operating away from established bases. The Air Force does not contain within itself the means for its own hospital treatment. Medical Service of the Air Force does not extend beyond aid stations, with no provision made for bed cases. The responsibility for the operation of

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hospitals at established bases is that of the station complement. The responsibility of an air base group is to provide away from the permanent base the services normally performed by the station complement at the permanent base. It appears therefore logical that the air base group upon establishing a temporary base should include in the installations thereat a small hospital of a capacity of approximately forty beds. Such a mobile hospital would permit the attention within the group of all slightly ill and injured patients. It would result in freeing the evacuation lines of the necessity of transporting these cases to the rear and would facilitate the early return of patients to their unit when fit for duty. A hospital of the bed capacity mentioned can be readily devised and equipped with standard items of the Medical Department supply table. Such hospital, however, must and can be kept mobile.

h. Control of CAA: It is essential that from the beginning of hostilities the Air Force Combat Command assume control of the CAA in order to regulate air traffic and prevent interference with military air movements by outside air activities.

i. Supply of 100-Octane Aviation Fuel: To provide for the contingency that other sources of supply may fail, it is recommended that consideration be given to the problem of manufacturing 100-Octane gasoline in the Second Air Force area. None of the 120 refineries now located in this area are equipped to supply aviation fuel of the Octane rating required. Available information indicates that the crude oil from fields in both Wyoming and Montana is satisfactory for refining 100-Octane aviation fuel. In view of the foregoing, it appears highly desirable that appropriate measures be taken without delay to provide a number of refineries in Wyoming and Montana with the necessary equipment which will enable them to furnish aviation fuel and oil.

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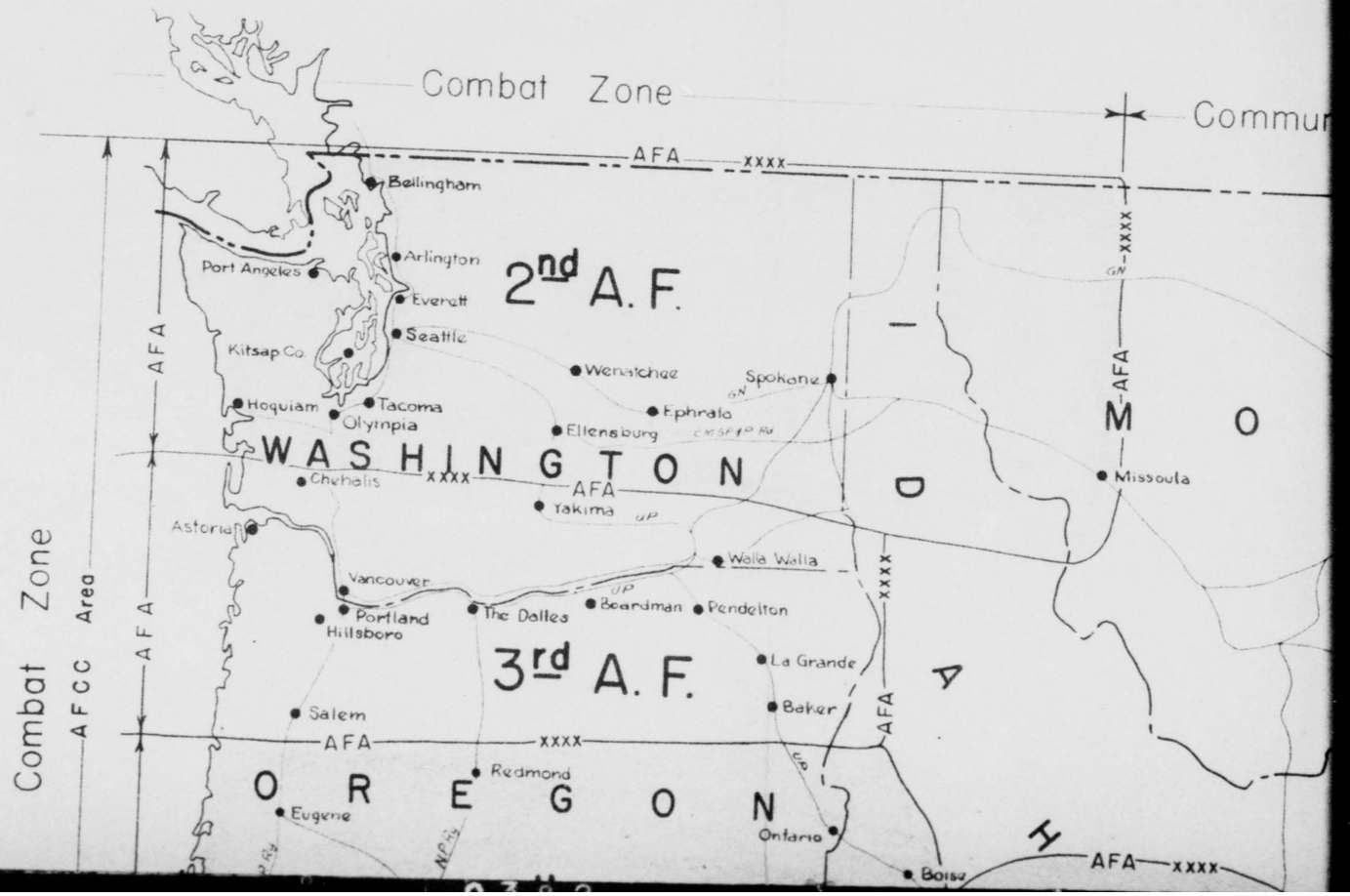

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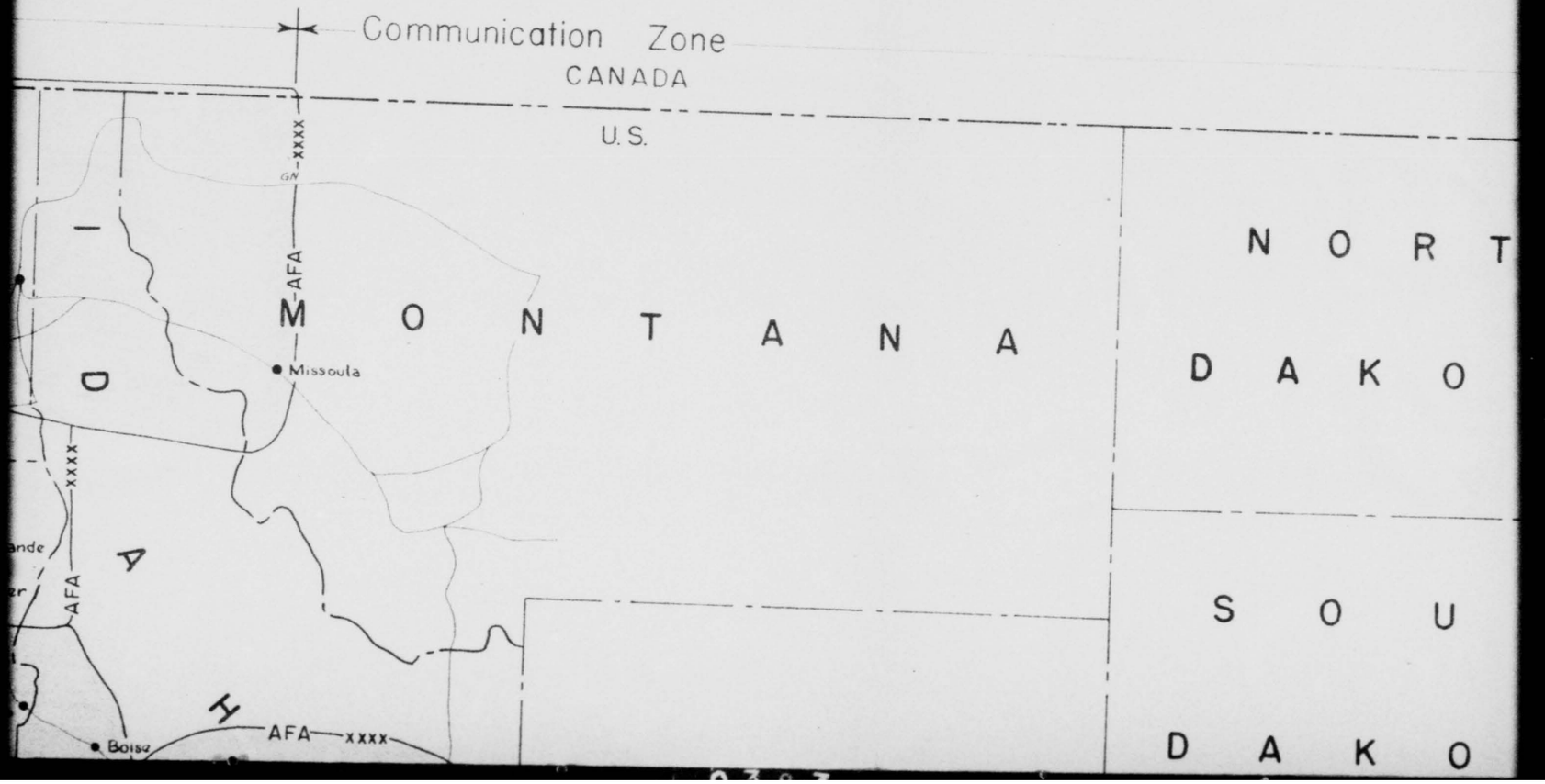

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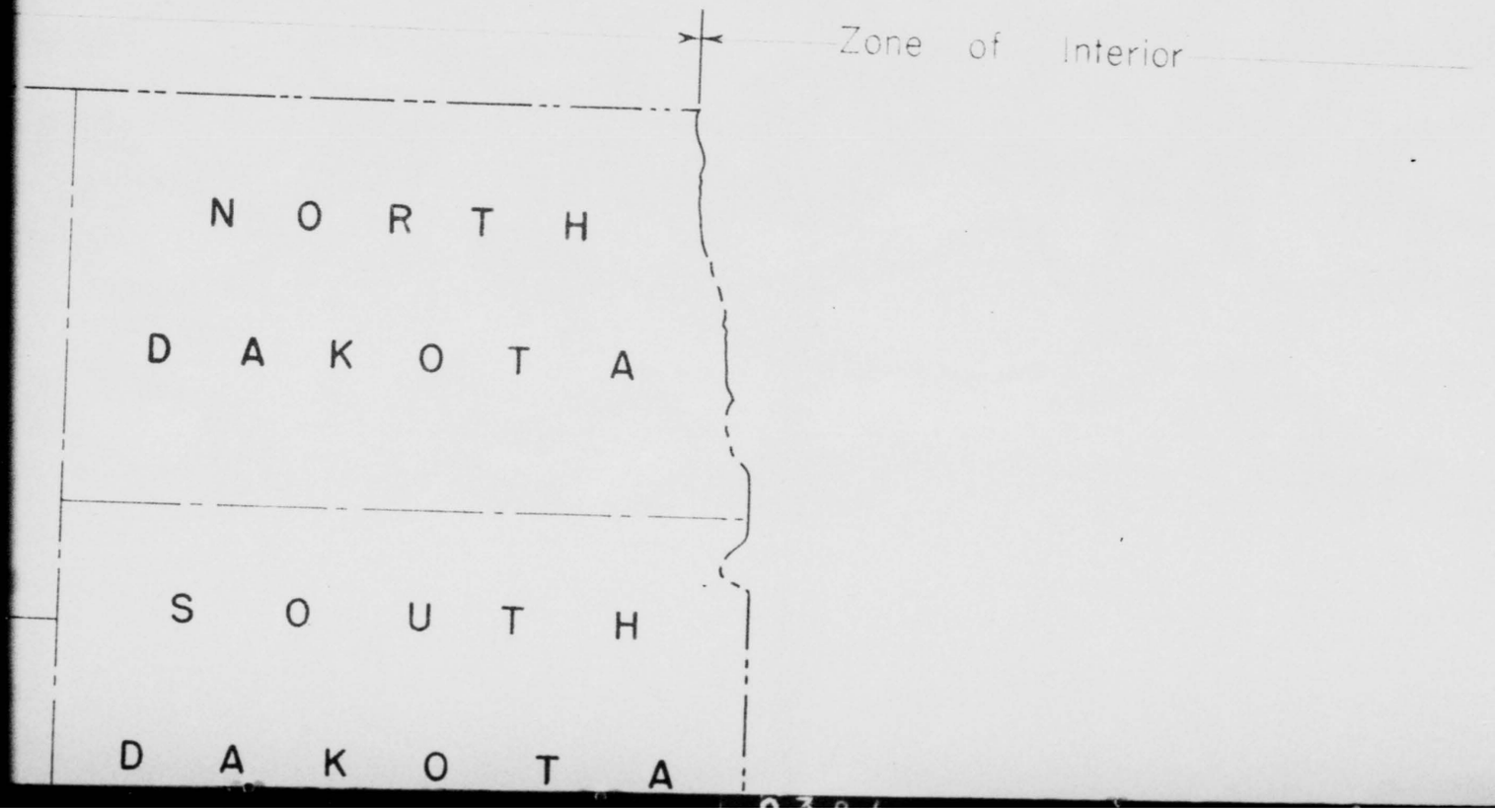

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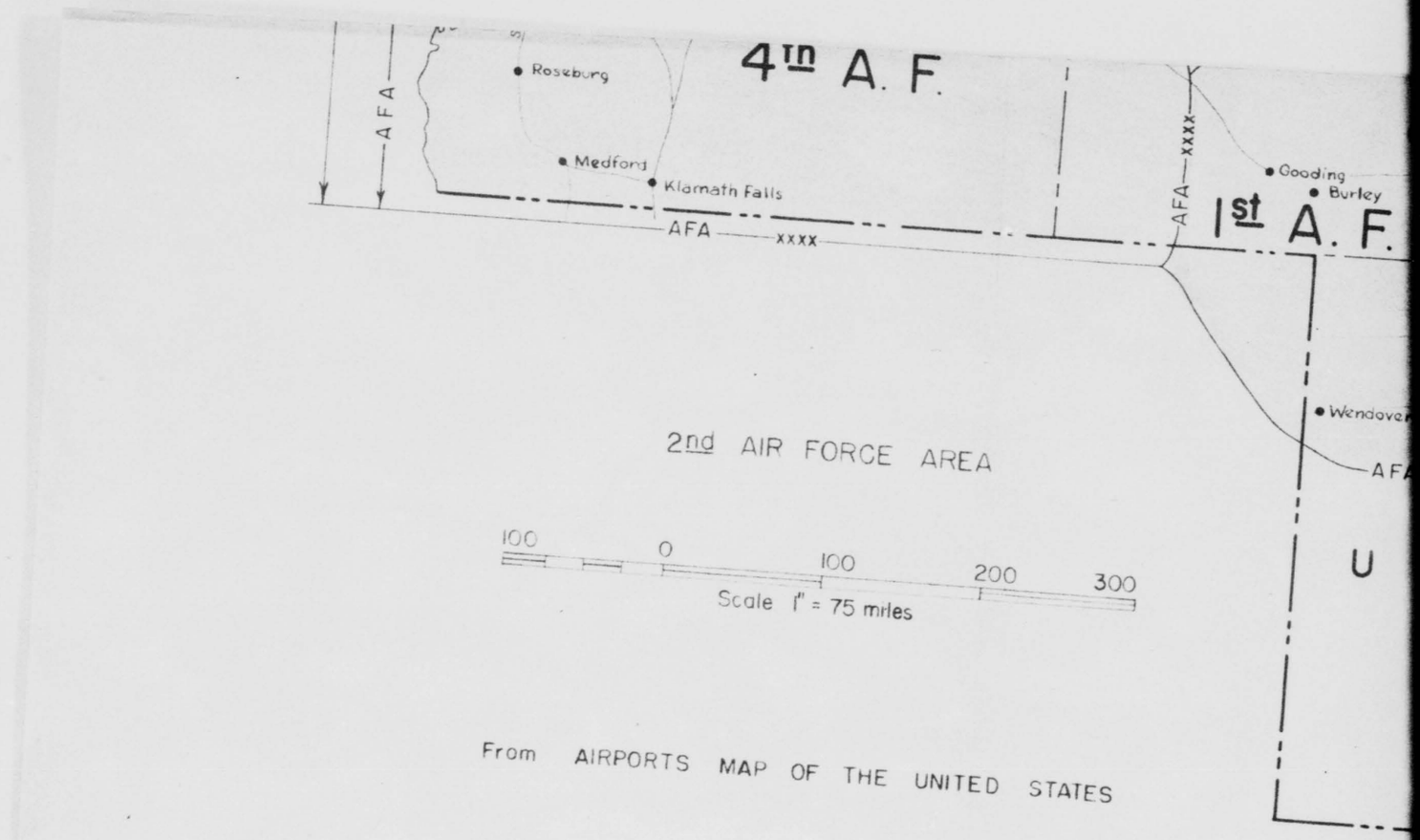

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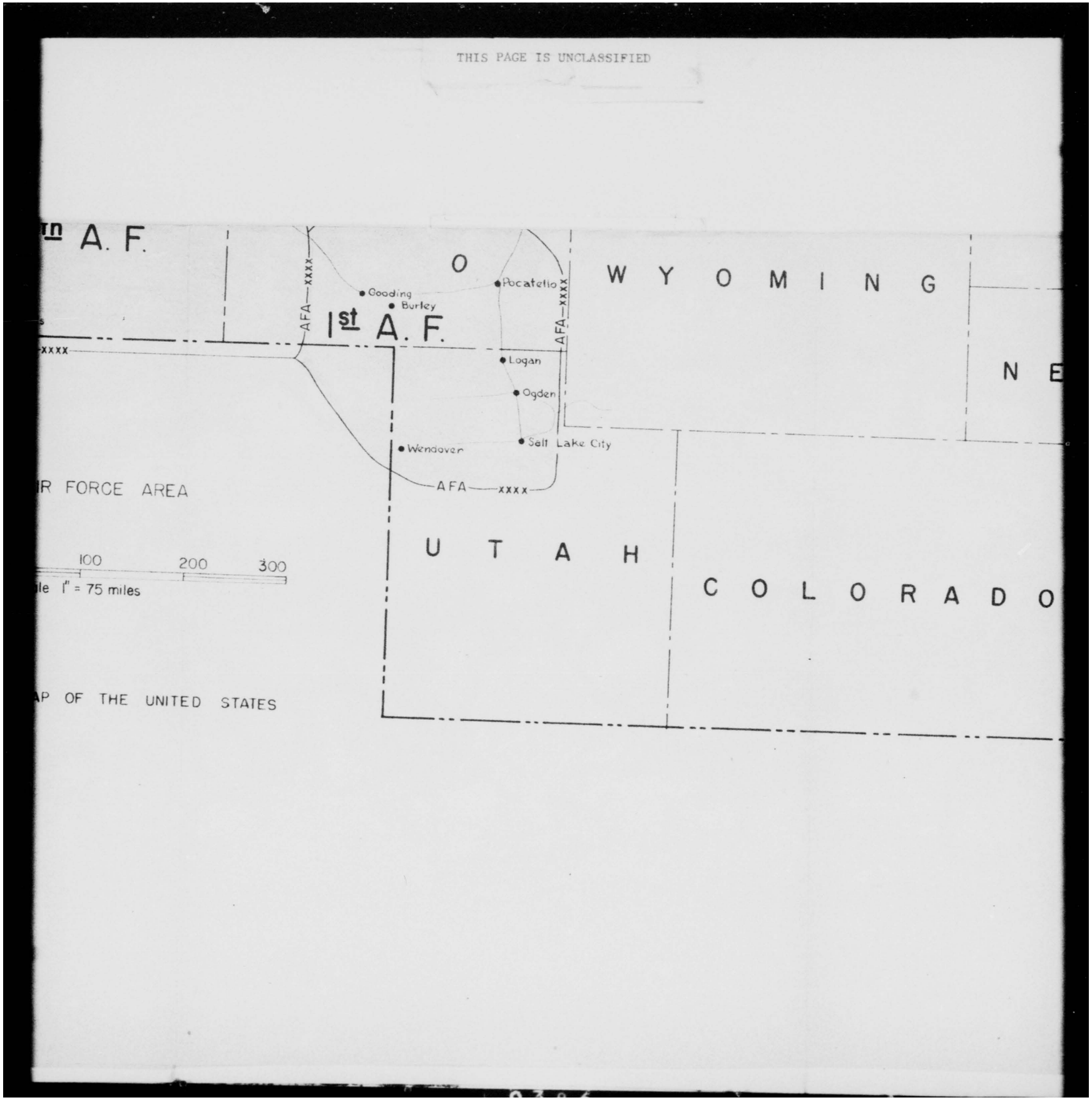

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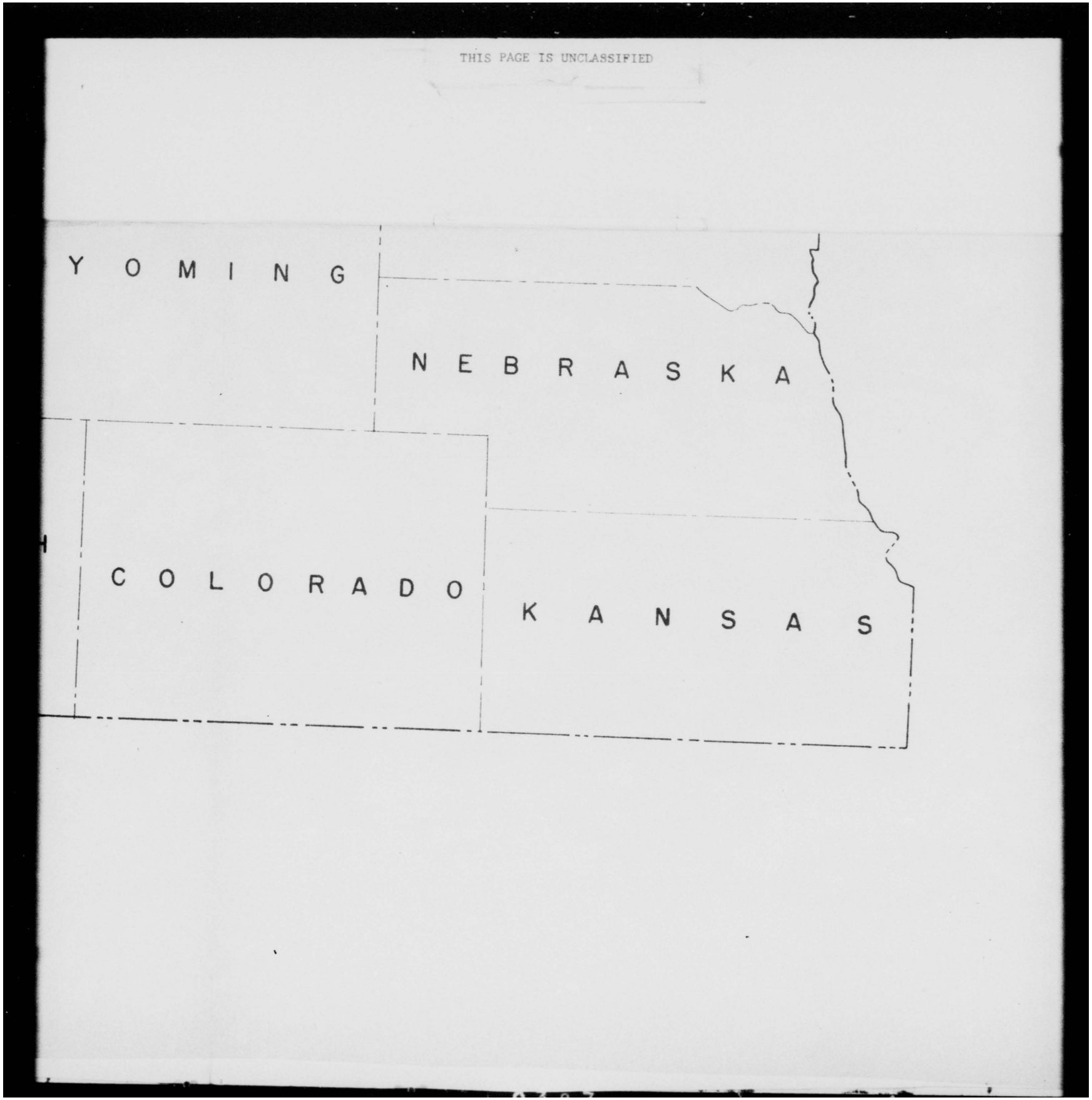

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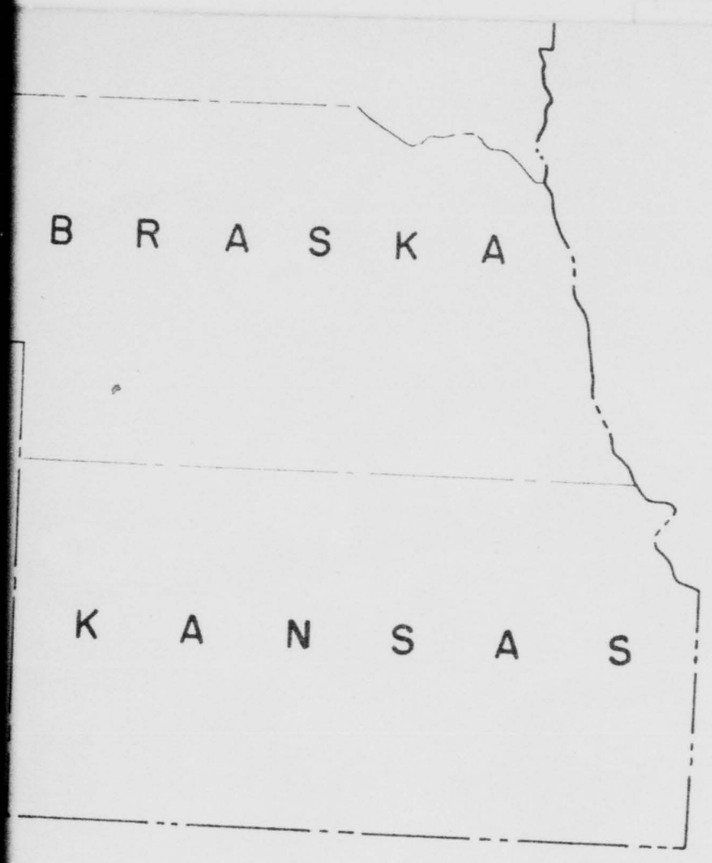

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PLATE NO. I

PICTORIAL WEATHER 2

LEGEND:-

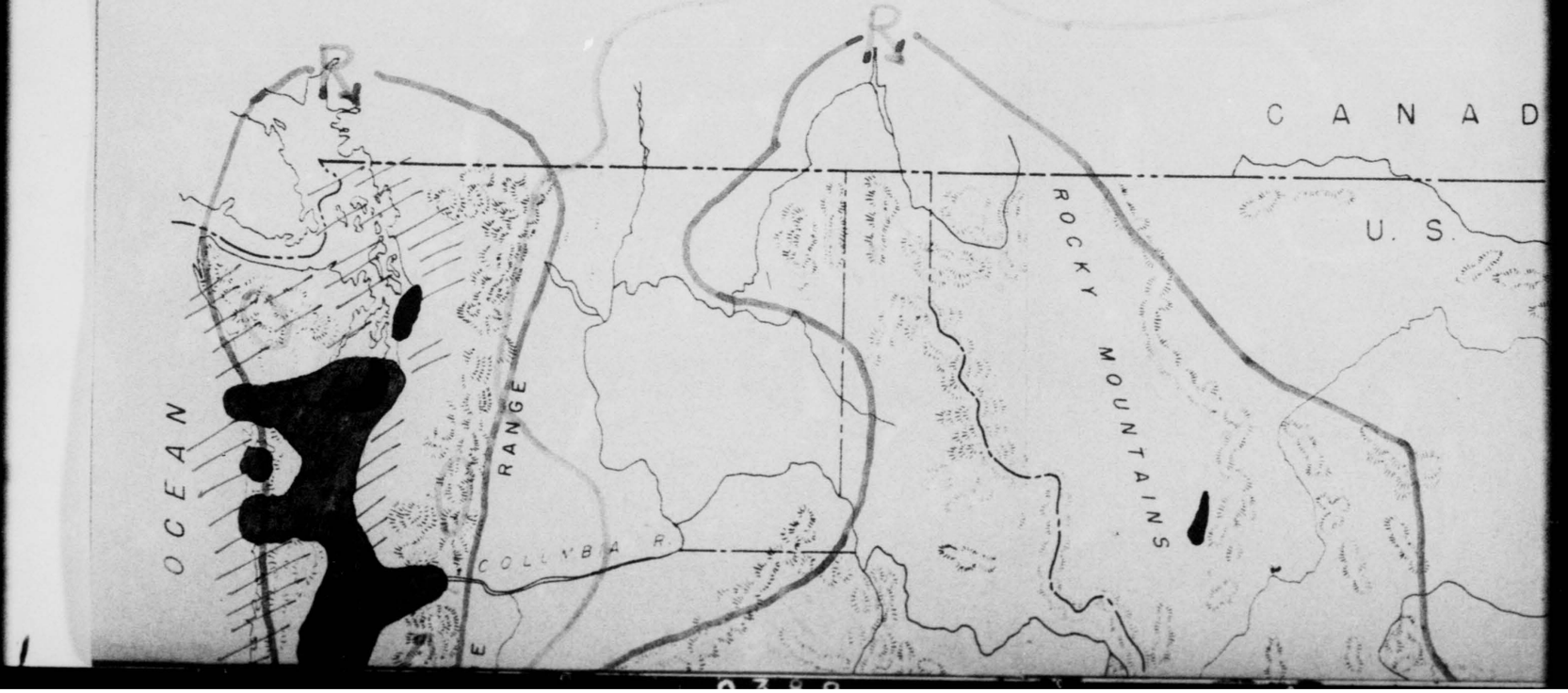
FOG AREAS

SMOKE AREAS

HIGH THUNDERSTORM ACTIVITY R

SEVERE ICING AREAS

AREA OF SNOW COVER



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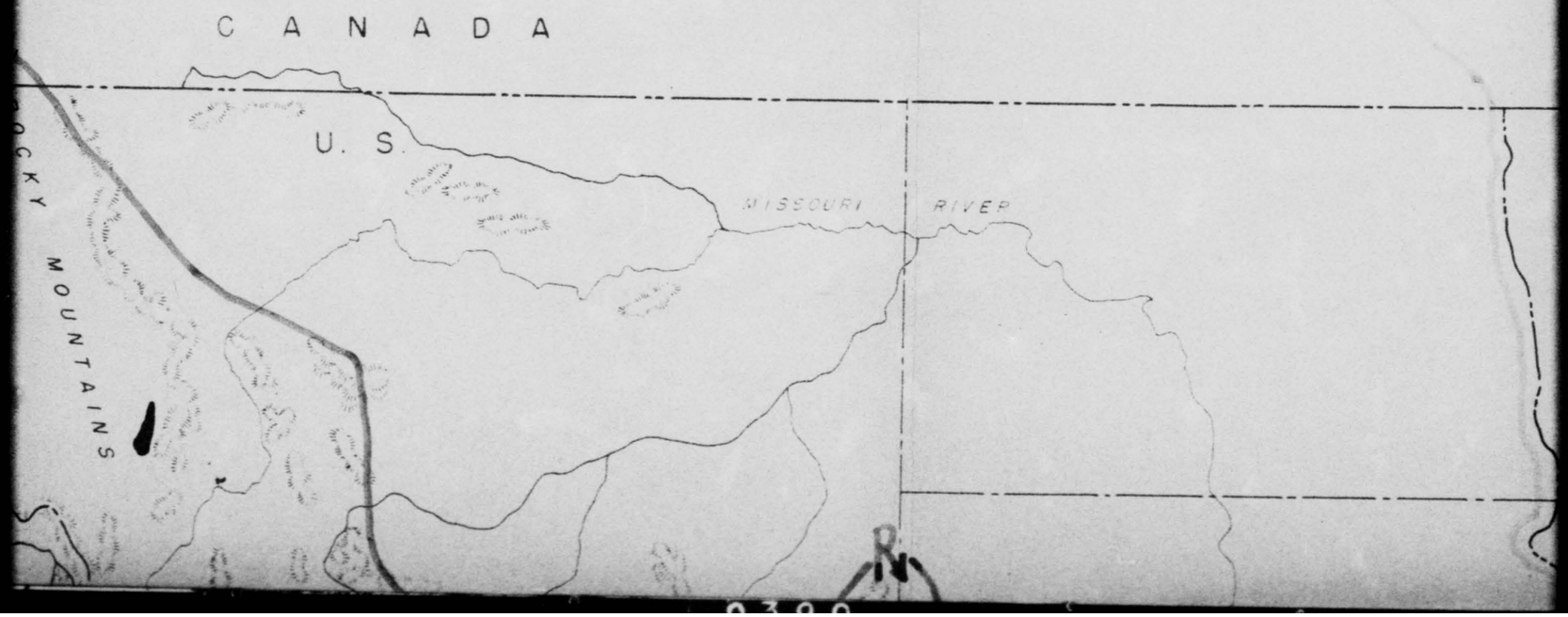
WEATHER 2D AIR FORCE PLATE NO

LATE FALL, WINTER, EARLY SPR

TY R



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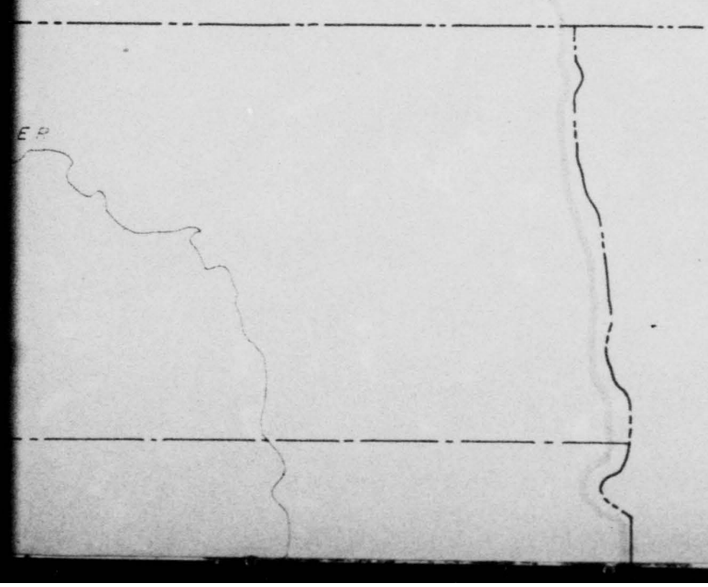
E PLATE NO. I

FALL, WINTER, EARLY SPRING.



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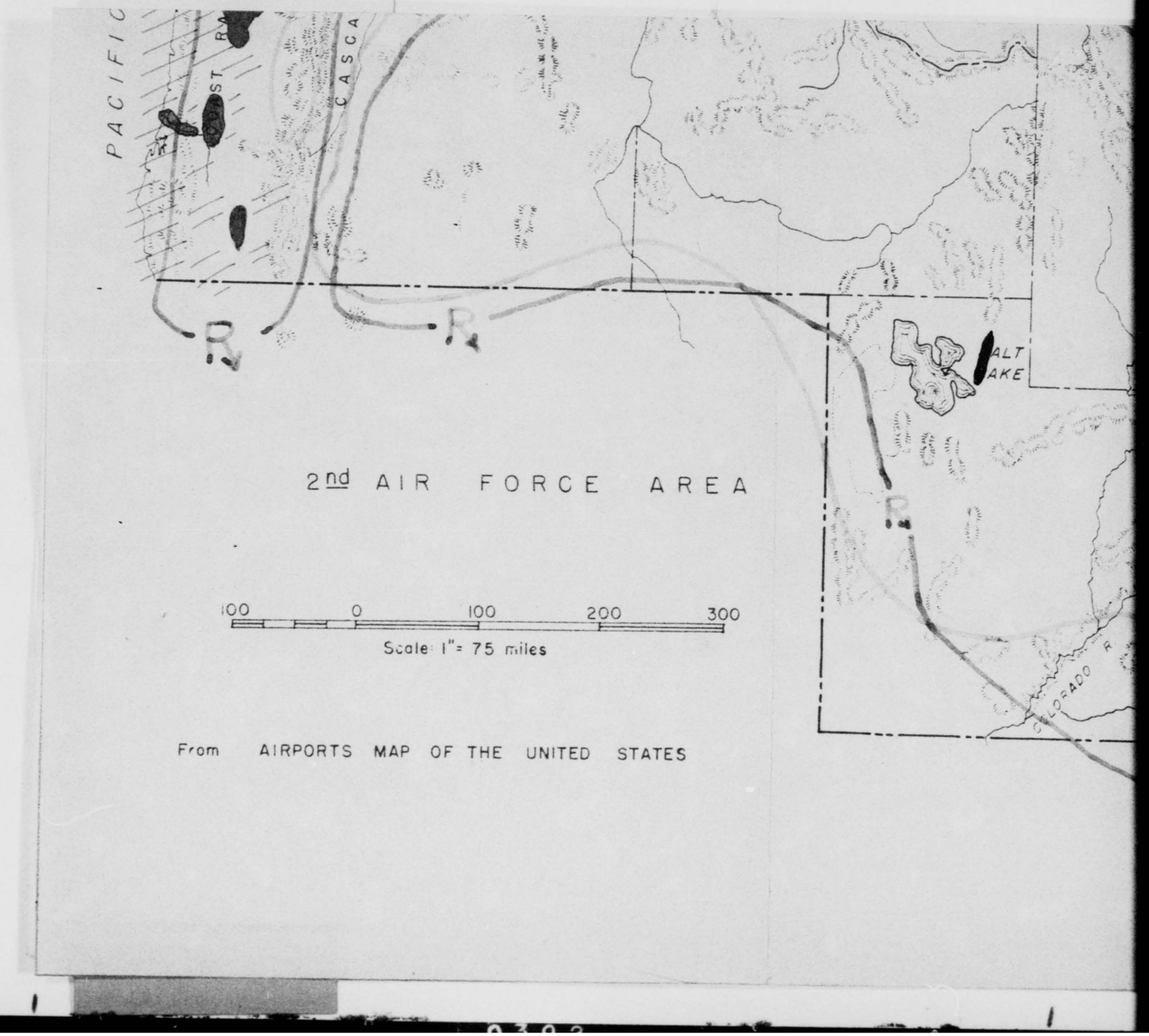

2nd AIR FORCE AREA

100 0 100 200 300

Scale: 1" = 75 miles

From AIRPORTS MAP OF THE UNITED STATES

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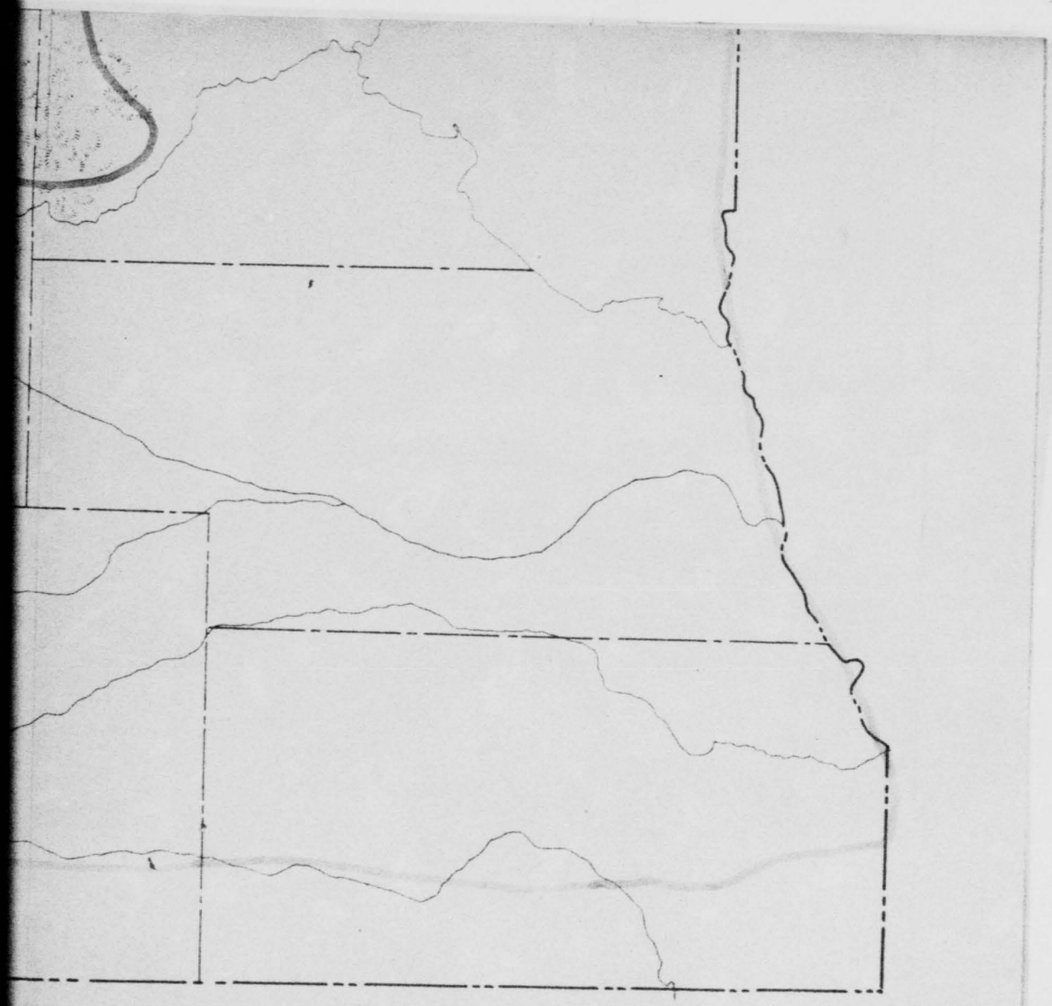

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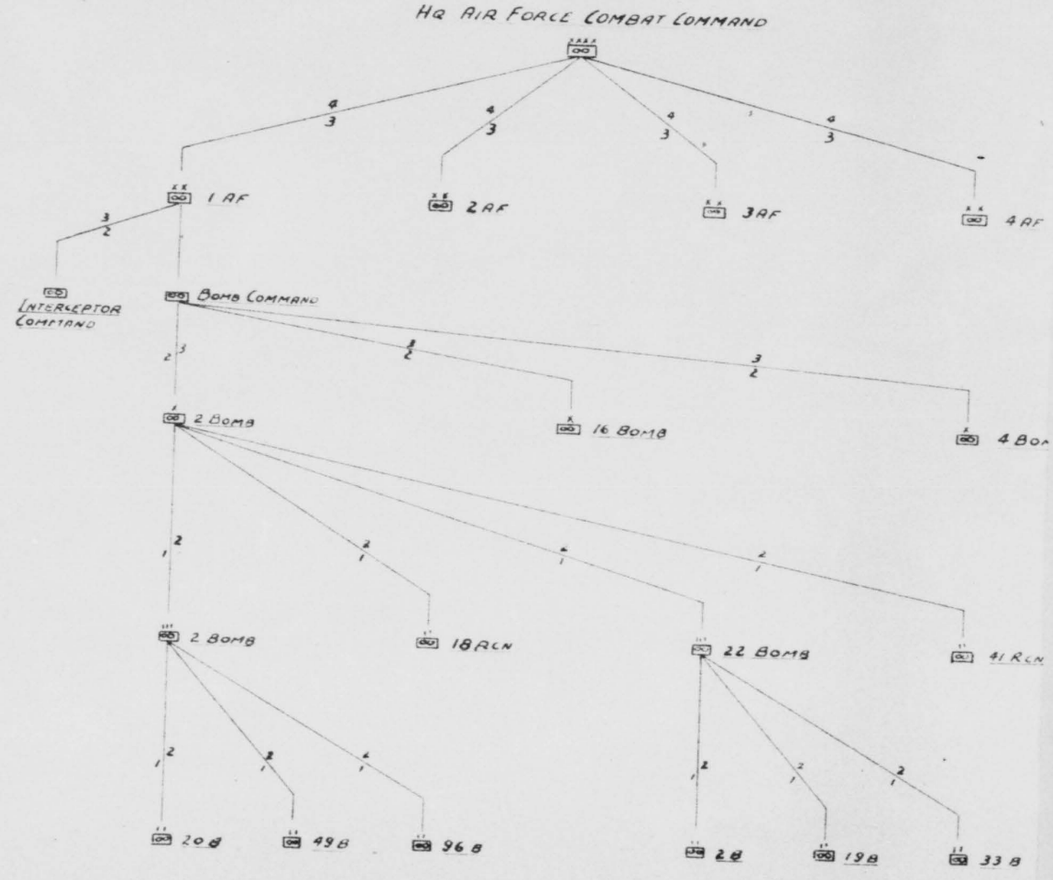
PLATE NO. I-C

— PL

TACTICAL COMMUNICATIONS NET
RADIO & WIRE



NOTE!
RADIO AND WIRE CIRCUITS IN OTHER AIR FORCE NETS ARE SIMILAR TO THIS EXAMPLE.

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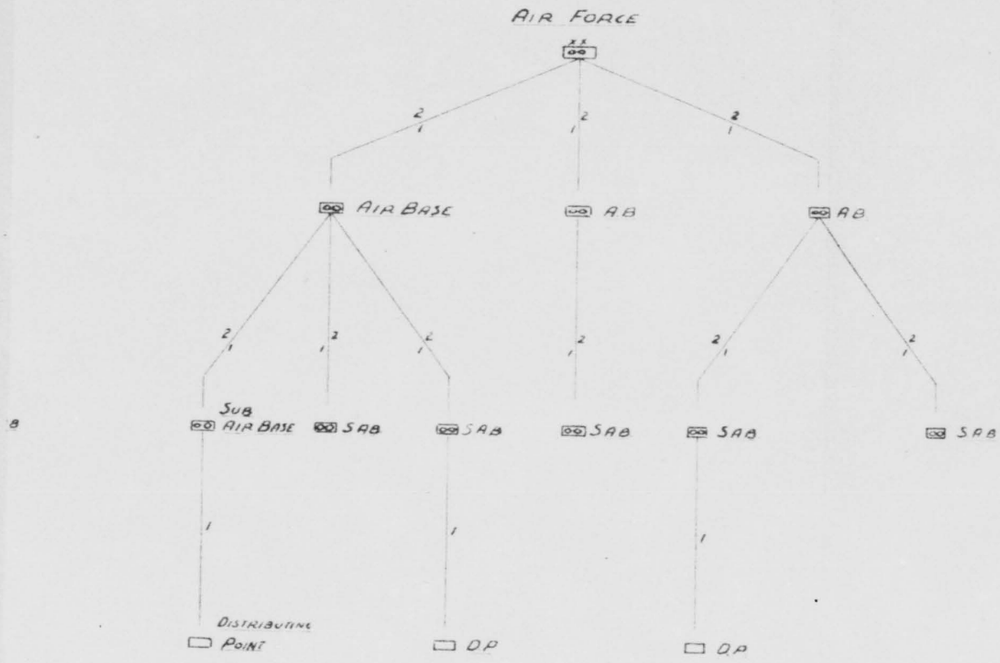
ATE IC —

ADMINISTRATIVE NET
RADIO & WIRE



LEGEND

4/3 - FOUR TELEPHONE AND THREE TELETYPE CIRCUITS

3/2 - THREE TELEPHONE AND TWO TELETYPE CIRCUITS

2/1 - TWO TELEPHONE AND ONE TELETYPE CIRCUITS

1 - ONE TELEPHONE CIRCUIT ONLY

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PLATE NO. I-B

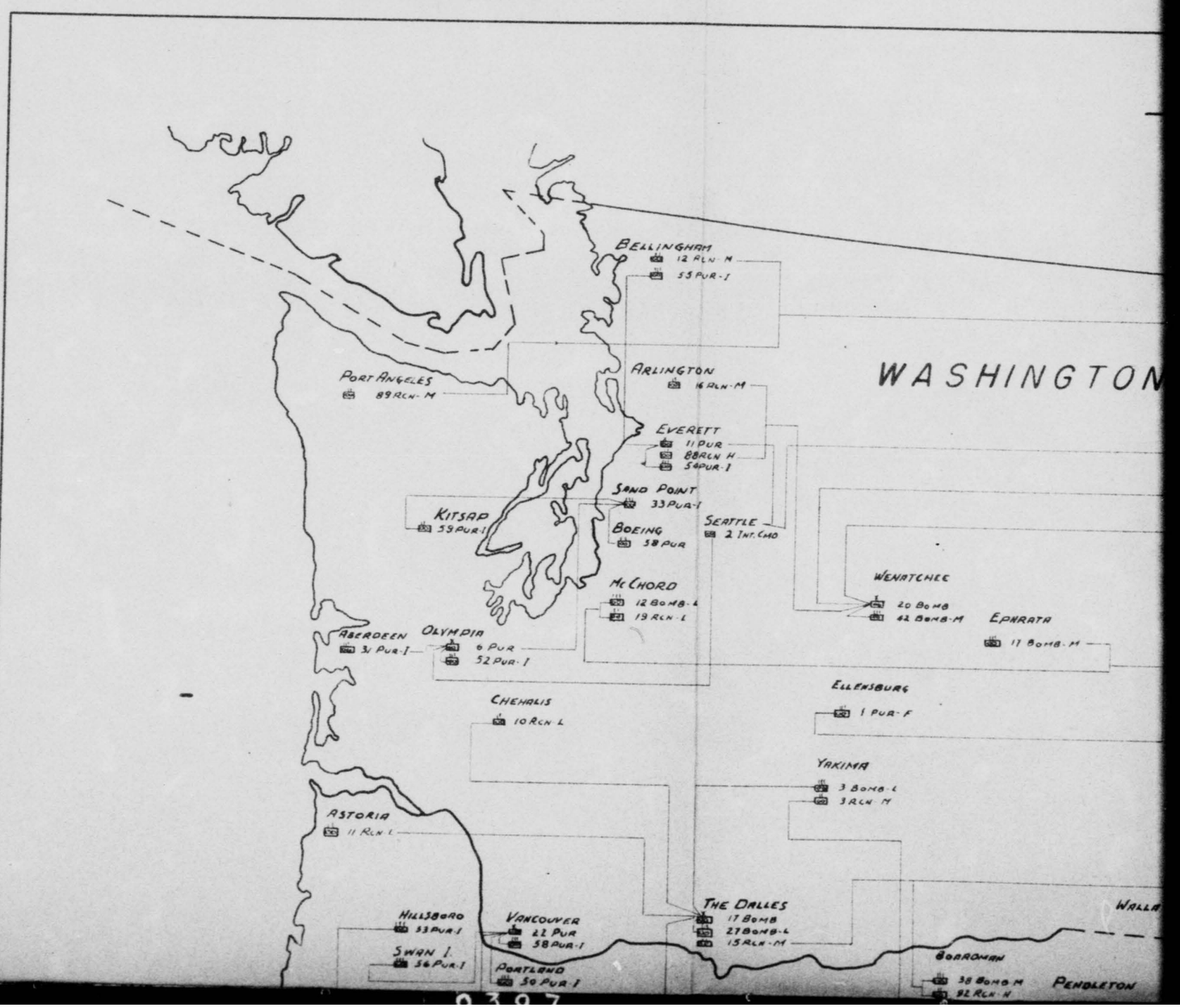

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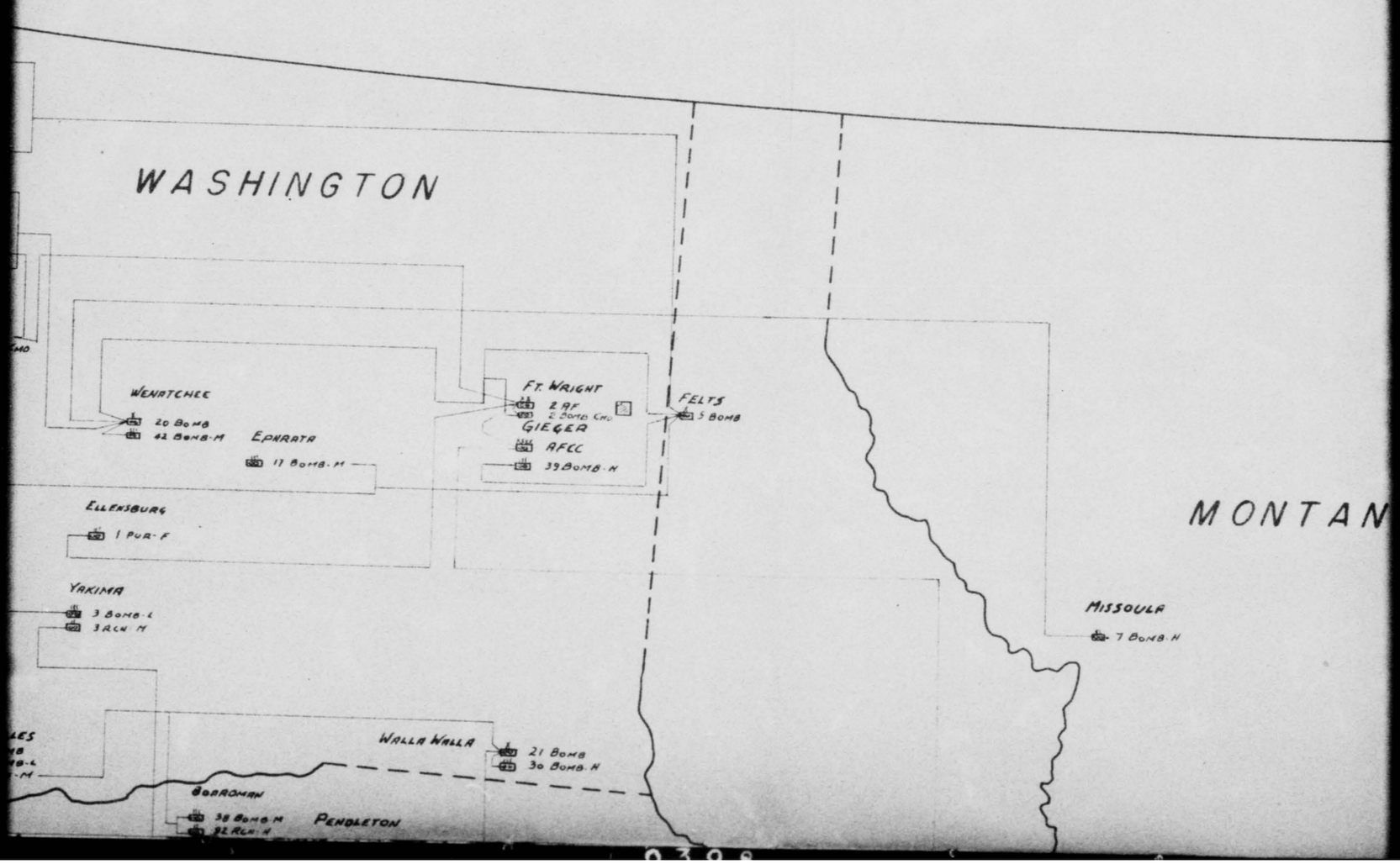
PLATE IB



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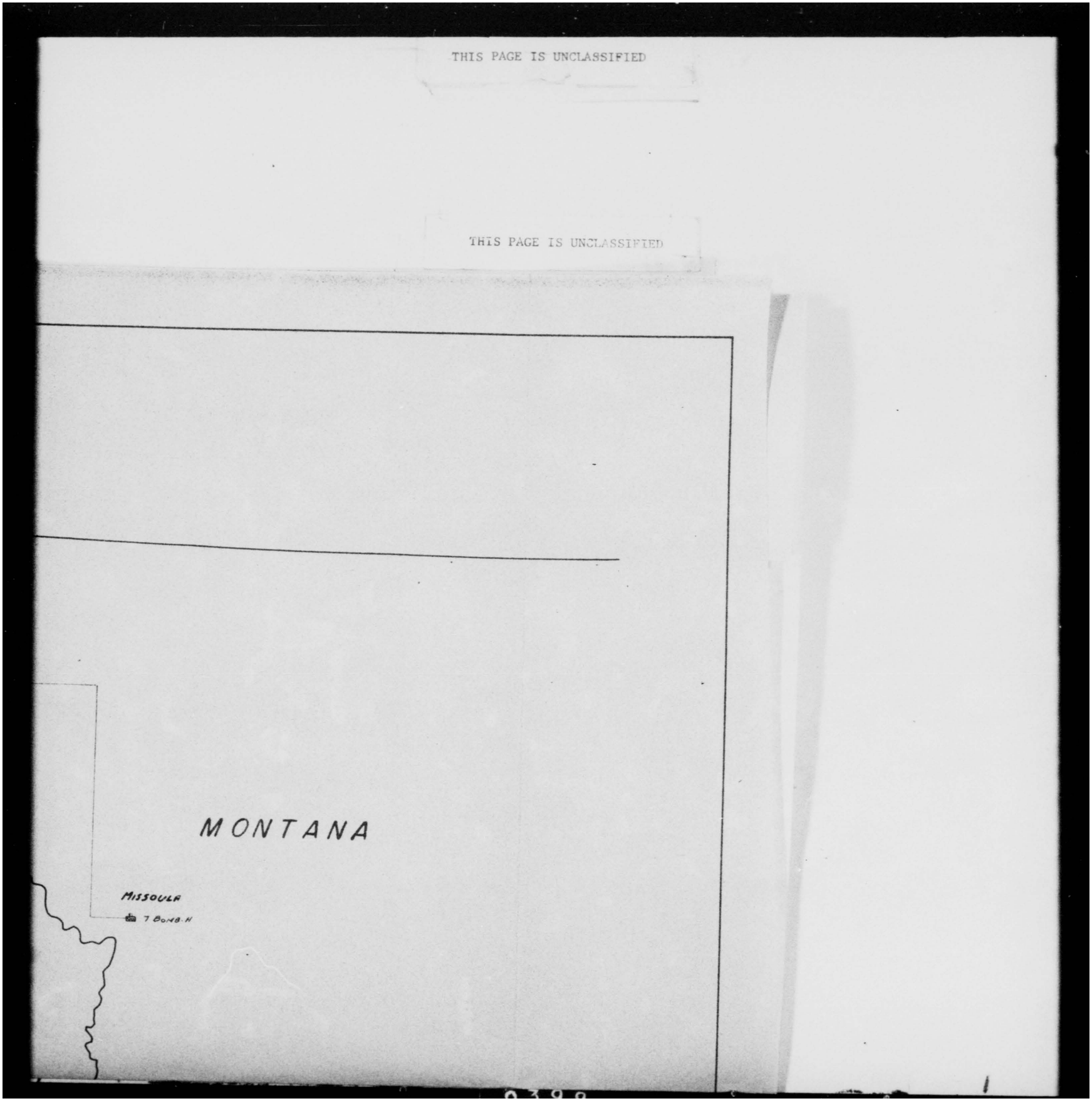

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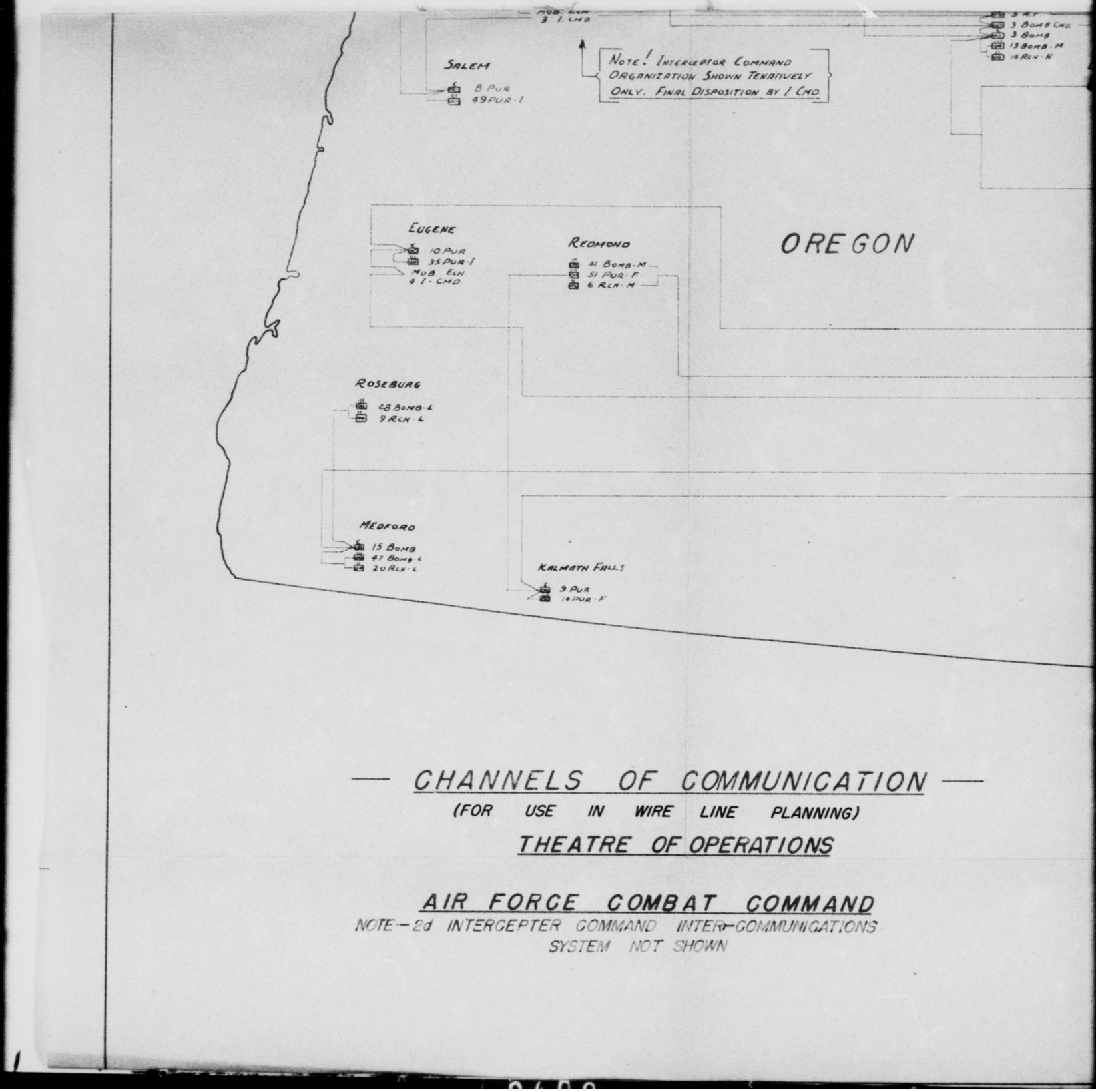

— CHANNELS OF COMMUNICATION —

(FOR USE IN WIRE LINE PLANNING)

THEATRE OF OPERATIONS

AIR FORCE COMBAT COMMAND

NOTE — 2d INTERCEPTER COMMAND INTER-COMMUNICATIONS SYSTEM NOT SHOWN

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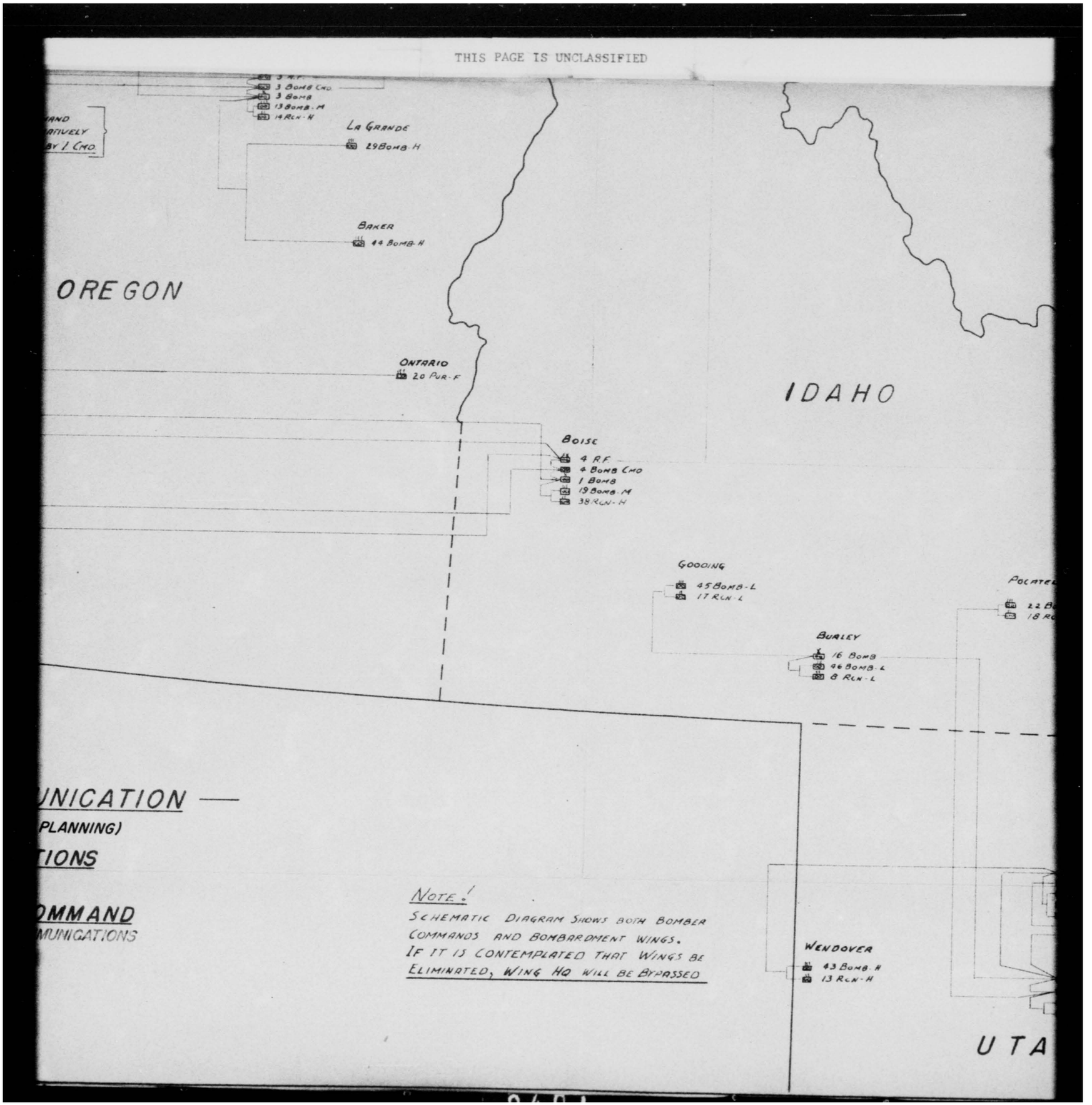

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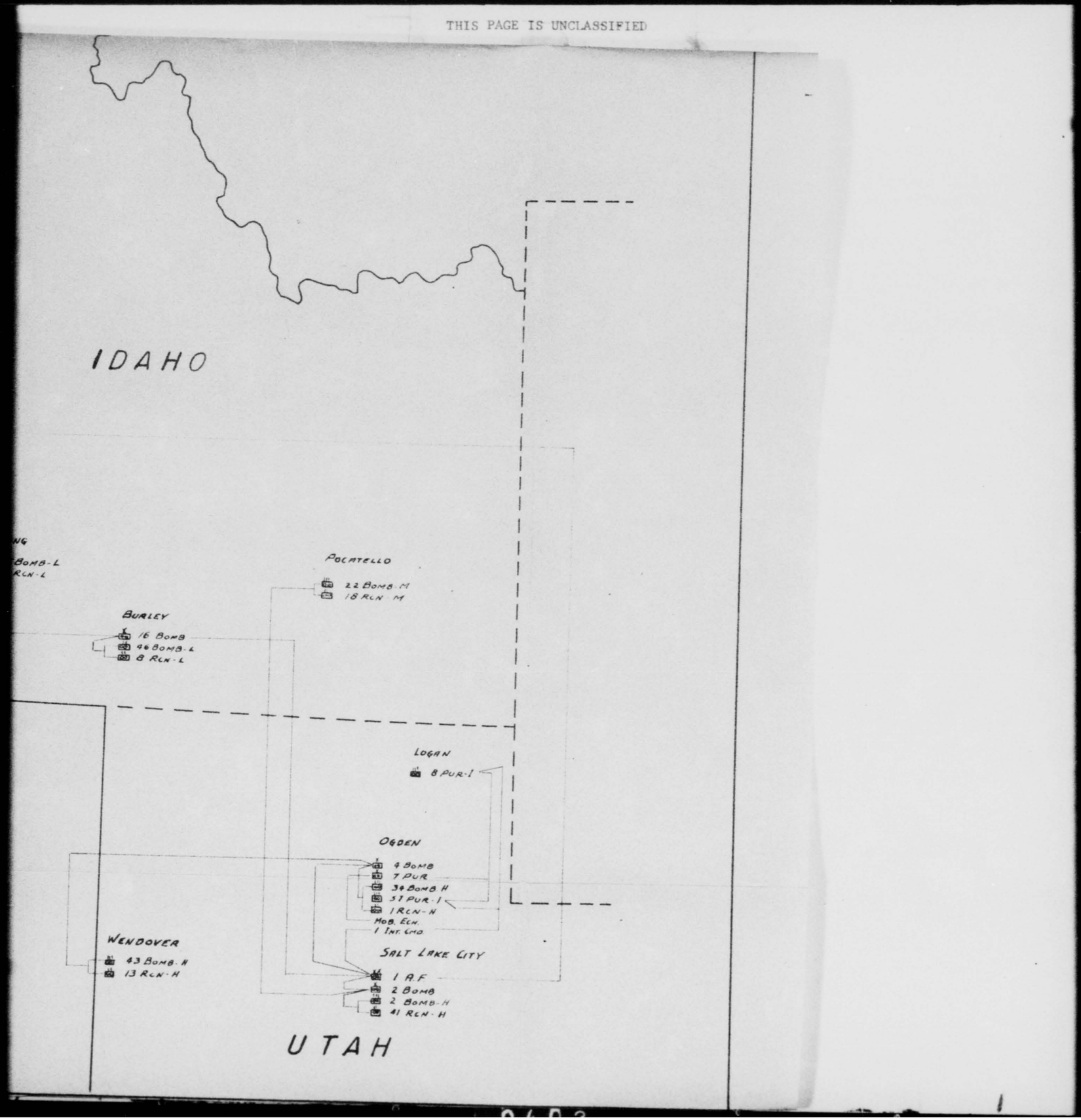

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OF THE AAF
PICTORICAL OFFICE

2ND AIR FORCE
SPECIFIC REQUIREMENTS
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RETURNED TO THE ARCHIVES OF THE AAF HISTORICAL OFFICE
FILE NO. 145.81-144
Orig Ltr

SECOND AIR FORCE HEADQUARTERS

DISPOSITION OF FIELD FORCES SECOND AIR FORCE

AIR FORCE COMBAT COMMAND

CONCENTRATION PACIFIC NORTHWEST AREA

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I N D E X

	PAGE
Distribution of Field Forces (General Discussion)	2-4, incl.

AIRDROME	COMBAT UNITS	SERVICE DESIGNATION		PAGE
Arlington, Washington	16th Rec. Sq. (M)	S A B	.....	6
Bellingham, Washington	58th Pursuit Group (I) 12th Rec. Sq. (H)	S A B	.....	7
Boeing Field, Seattle, Washington	58th Pur. Sq. (I)	S A B	.....	8
Ellensburg, Washington	1st Pur. Gp. (F)	S A B	.....	9
Ephrata, Washington	17th Bomb. Gp. (M)	S A B	.....	10
Everett, Washington	Hq. & Hq. Sq. 11th Pur. Wg. (320th Sig. Co. Avn. Wg.) 54th Pur. Gp. (I) 88th Rec. Sq. (H)	A B	.....	11
Pelts Field, Parkwater, Washington	Hq. & Hq. Sq. 5th Bomb Wg. (314th Sig. Co. Air Wg.)	S A B	.....	12
Fort George Wright Washington	Hq. & Hq. Sq. 2nd Air Force (310th Sig. Co. Avn.) (434th Sig. Co. Maint)	S A B	.....	13
Geiger Air Base, Washington	Hq. & Hq. Sq. AFCC (301st Sig. Co. Avn.) 39th Bomb Gp. (H)	A B	.....	14
Hoquiam, Washington	31st Pur. Gp. (I)	S A B	.....	15
Kitsap County Airport	59th Pur. Sq. (I)	S A B	.....	16
McChord Air Base, Washington	12th Bomb Gp. (L) 19th Rec. Sq. (L)	A B	.....	17

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(INDEX---continued)

AIRDROME	COMBAT UNITS	SERVICE DESIGNATION		PAGE
Missoula, Montana	7th Bomb Gp. (H)	A B	.....	18
Olympia, Washington	Hq. & Hq. Sq., 6th Pur. Wg. (315th Sqdn. Oc. Air Wg.)			
	52nd Pur. Gp. (I)	S A B	.....	19
Port Angeles, Washington	89th Rec. Sq. (M)	D P	.....	20
Sand Point, Washington	32nd Pur. Gp. (I) (less 2 sqs.)	S A B	.....	21
Wenatchee, Washington	42nd Bomb. Gp. (M) Hq. & Hq. Sq., 20th Wing 326th Sqdn. Oc. Air Wing	S A B	.....	22

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DISTRIBUTION OF AIR FORCES

1. General Discussion:

a. Initial Disposition of Combat Elements:

(Refer to Plate 2)

The Second Air Force is assigned the extreme northern area of the theater of operations, as shown by Plate I. In this area many of the Second Air Force units are stationed at present, and no redisposition of forces will be required. It is believed that the most likely threat by the enemy will be delivered against that part of the coastal frontier located in the Second Air Force operating area, as shown in Plate 1; i.e.: the Seattle and Tacoma industrial centers.

Reconnaissance Units will, undoubtedly begin operations even before the concentration by other units of the Second Air Force is complete and should, therefore, be initially based at advance airdromes, which will permit their operations to the maximum distance seaward. It is contemplated that these Reconnaissance Units be ultimately withdrawn to the east of the Cascade Mountains in the event that a beachhead is effected by the enemy at a distance which would constitute a threat to the advance operating bases occupied by them.

Heavy Bombardment Units, located in the rear of the Cascade Mountains, must be provided with suitable advance refilling points for bombs and aviation fuel in order to extend their range

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to the seaward, McChord Field has been designated as the advance refilling point for Heavy Bombardment Units. The Light Bombardment Units located thereat will not interfere with refilling operations of Heavy Bombardment Units, because Light Bombardment is primarily used to counteract bombing operations, at which time Heavy Bombardment Units will refill west of the mountains.

Medium Bombardment is based as shown in Plate 2, at a range which will permit operations to some extent to the seaward, which range can be increased by airplanes refueling at coastal airdromes either before or at the completion of their mission. In order to insure the safety of bombardment refilling operations at coastal stations, it is imperative that the refilling points be adequately protected by Interceptor Pursuit. Three Pursuit Groups from the First Air Force, which is in general reserve in the Salt Lake area, are attached to the Second Interceptor Command and are based as shown in Plate 2. This gives a total of five Pursuit Groups available for defense of the refilling points, air bases and industrial centers of Seattle and Tacoma. It is believed that this number is sufficient.

One group of Fighter Pursuits (First Pursuit Group (F)) is attached direct to the Headquarters Second Bomber Command for escort missions to be used at the discretion of the Bomber Commander. This group is based east of the Cascade Mountains, because, oftentimes the coastal regions are completely overcast and it would be difficult for a unit based therein to effect an escort

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rendevouz. This unit, from its base east of the mountains, will be able to escort bomber formations over the top of the overcast that prevails the major part of the year in the mountain ranges and in the coastal regions.

b. Initial Disposition of Service Elements:

(Refer to Plate 2-A)

Due to the lack of suitable operating airdromes throughout the entire Second Air Force area, units will not be able to operate from disbursed airdromes under the DP system. It is necessary to organize a number of sub-air bases as shown in Plate 2-A. In the organization of sub-air bases, an attempt is made to assign those service elements of air base group to the airdromes occupied by the tactical units that they normally service in peace time operations. It is believed that a materiel squadron that is accustomed to maintaining pursuit type airplanes will be better qualified to operate pursuit airplanes in the field and should, therefore, service airdromes occupied by Pursuit Units.

The fixed air base installations of McChord, Everett and Geiger are supplemented by Air Force Replacement Depots for both airplanes and personnel. It is necessary to create a new air base at Missoula in order to prevent "back tracking" of supplies routed in from the east and in order to establish a reservoir for certain vital war supplies that are at the present time located in the Seattle area, which area is most vulnerable to

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hostile attack.

Each Pursuit Wing in the Second Air Force area is assigned a Transport Squadron. It is contemplated that these squadrons be used to transport personnel to operating areas and to facilitate the supply service between DP'S, sub-air bases and the air bases.

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STATION LIST, SECOND AIR FORCE

Initial Distribution of Field Forces and Service Units

ARLINGTON, WASHINGTON

(Lat 48° 11' Long 122° 09')

Combat Units	Service Units D. P.
16th Rec Sq (H)	DP fr 34th AB Gp (less Det from Everett)
	Pl 453rd Ord Co Avn (B)
	Det 4th Chem Co Serv Avn

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BELLINGHAM, WASHINGTON

(Lat 48° 46' Long 122° 30')

Combat Units	Service Units (Sub-Air Base)
55th Pur Gp (I)	43rd AB Gp (less AB Sq)
12th Rec Sq (H)	35th Sig Pl (AB)
	723rd Ord Co Avn (AB)
	684th Ord Co Avn (P)
	Co M 34th QM Regt (Trk)(col)
	2nd Pl Co B 91st QM Bn (IM) (less Dets)
	Det 4th Chem Co Ser Avn
	Det 2nd QM Co Sup Avn
	16th Transport Sq
	Pl 455th Ord Co Avn (B)
	Det 434th Sig Maint Co Avn
	Det Finance
	Attached Medical

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SECOND AIR FORCE

QUARTERMASTER CORPS SUPPLIES

CLASS I

Base	Officers	Enlisted Men	Rations	Gas Fuel
Arlington, Washington	65	319	3947	110
Boeing Field, "	37	365	4422	220
Ellensburg, "	154	1271	16330	990
Ephrata, "	291	1867	22008	2090
Bellingham, "	257	2482	28756	2530
Everett, "	240	2513	29264	2200
Felts Field, "	25	292	3498	220
Geiger Field, "	278	2395	29203	2640
Fort George Wright, "	135	1612	9286	660
Hoquiam, "	171	1965	22100	1980
Kitsap, "	37	365	4433	110
McChord Field, "	199	2031	24530	1870
Fort Lewis, "	18	634	7172	330
Missoula, Montana	186	1794	21978	1870
Olympia, Washington	220	2327	24910	1540
Port Angeles, "	64	319	4213	110
Sand Point, "	166	1818	20916	1760
Wenatchee, "	299	2078	23258	2200
Total	2742	26447	300524	23430

Note: The total rations shown are the requirements for ten days plus ten percent (10%); the total fuel shown is based on an allowance of ten gallons (10) per day per range.

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SECOND AIR FORCE

Quartermaster Supplies - Class II.

Bases:	Officers	Enlisted Men	Tentage "A"	Tentage "B"	Tentage "C"	Tentage "D"	Field Ranges
Arlington, Washington	65	319	71	8	14	83	1
Boeing Field, "	37	365	41	8	14	92	2
Ellensburg, "	154	1271	191	8	12	295	9
Ephrata, "	191	1867	275	18	27	432	19
Bellingham, "	257	2482	302	24	33	570	23
Everett, "	240	2513	283	25	32	580	19
Felts Field, "	25	292	28	5	5	64	2
Geiger Field, "	278	2395	319	21	30	549	21
Fort George Wright,"	135	1612	116	4	4	160	6
Hoquiam, "	171	1965	202	22	27	453	18
Kitsap, "	37	365	49	9	14	92	1
McChord Field, "	199	2031	233	19	28	468	17
Fort Lewis, "	18	634	20	2	6	140	4
Missoula, Montana	186	1794	185	22	27	314	17
Olympia, Washington	220	2327	251	27	28	524	14
Port Angeles, "	64	319	70	5	5	70	1
Sand Point,(NAB)"	166	1618	197	22	27	424	16
Wenatchee, "	209	2078	278	27	31	459	20
	2457	26447	3144	282	358	5964	209

Note: Tentage includes actual allowances plus ten percent for replacement.

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SECOND AIR FORCE

QUARTERMASTER CORPS SUPPLIES

CLASS III

Base	Officers	Enl. Men	Gasoline	Trans. Oil	Motor Oil	Grease
Arlington, Wash.	65	819	18637	212	721	208
Boeing Field, Wash.	37	385	10257	81	708	216
Ellensburg, Wash.	154	1271	9132	491	3213	1296
Ephrata, Wash.	191	1807	153120	726	5259	1920
Bellingham, Wash.	257	2482	164472	729	5808	1960
Felts Field, Wash.	25	293	22767	114	911	328
Everett, Wash.	240	2513	169408	734	6125	2096
Geiger Field, Wash.	278	2935	187390	819	3815	2296
Fort George Wright, Wash.	135	1612	117091	529	4392	736
Hoquiam, Wash.	171	1965	179185	751	6368	1928
Kitsap, Wash.	37	365	16244	57	401	192
McChord Field, Wash.	199	2081	156288	665	5280	1904
Fort Lewis, Wash.	18	634	62106	302	2550	688
Missoula, Montana	186	1794	116868	533	3709	1464
Olympia, Washington	220	2327	286352	826	6520	2192
Port Angeles, Wash.	64	319	19483	82	767	232
Sand Point, Wash.	166	1818	111120	660	3722	1320
Wenatchee, Wash.	299	2078	153384	692	5227	1928
Totals -	2742	26447	2043374	9003	66096	22904

NOTE: The requirements of Gasoline, Transmission Oil, Motor Oil and Grease are based on the total authorized motor vehicles for each base; the amounts shown in the totals above cover the actual requirements for ten (10) days plus ten percent (10%), or the actual amounts required for 264 hours.

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MEDICAL REQUIREMENTS

SECOND AIR FORCE SERVICE AREA

C O N T E N T S

1. Hospitalization and Evacuation. (Discussion and Charts)

2. Hospitals available. (List)

3. Medical Supply. (Discussion)

4. Medical Supplies.-
Stockage - 10 day period - Medical Supply Section,
Second Air Force,
Fort George Wright, Wash.

MEDICAL REQUIREMENTS

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HOSPITALIZATION AND EVACUATION

SECOND AIR FORCE

1. Hospitalization.

Troop Strength	29813	
Estimated Hospital Beds Required	1438	
Estimated Hospital Beds Available (military and civil, with expansion of military hospitals) . .		1161
Additional Mobile Units Required from Army - Hospital Station (1)		250
Total Beds Provided For		1411

The situation as regards hospitals in the eastern and central sections of the Area of the Second Air Force is satisfactory. The military hospitals at Fort Worden, Everett, McChord Field, and at Fort Lewis, the Naval Hospital at Bremerton, and the civilian hospitals in this section will furnish adequate hospital beds for the air troops in the area, and it is not believed that there will be any great demand upon the large Station Hospital at Fort Lewis. This hospital has, in fact, been left practically free in this study for the ground troops. The central section is readily provided for hospital beds by the establishment of a hospital station of 250 beds at Ellensburg and by an expansion of the facilities at Fort George Wright.

In the extreme eastern portion of the area, however, there are no military hospitals, there is only one hospital at Missoula, and the nearest additional civilian hospitals are at Helena. It is estimated that 70 hospital beds should be provided for the troops in the Missoula area. The Veterans Facility and the civilian hospitals of these two cities have a total of 395 beds. It is assumed that 20%, or 79, of these beds would be available for Army use, and therefore it is not planned to install any Army mobile hospital unit at Missoula. It is quite likely that the present facilities at Old Fort Missoula would be available for Army use, as it is assumed the use of Fort Missoula as a concentration place for enemy aliens would be discontinued if the inclusion of this area in the combat zone became eminent.

2. Evacuation.

First class paved roads connect all points in the western and central sections of the area, and the distances between troop and hospital points are not excessive; the rail communications are likewise excellent. The distance between Spokane and Missoula in the eastern section is 207 miles over mountainous roads and is believed too great for ambulance transport of patients. (See above.) Rail evacuation of the entire area is feasible by the rail net. A chart showing hospital points, bed capacity, and distances is attached. If the military situation requires a withdrawal from the coastal area east of the Cascades, additional mobile hospital units will have to be obtained from the Army.

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BOEING FIELD, SEATTLE, WASHINGTON

(Lat 47° 32' Long 122° 18')

Combat Units	Service Units D. P.
56th Pur Sq (I)	1 DP fr 2nd AB Gp (R)
	Pl 683rd Ord Co Avn (P)
	Det 1st Chem Co Serv Avn

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ELLENSBURG, WASHINGTON

(Lat 47° 02' Long 120° 32')

Combat Units	Service Units (Sub-Air Base)
1st Pur Gp (F)	3rd AB Gp (P) (less Det Hq & Hq Sq & 1 Mat Sq)
	685th Ord Co Avn (P)
	726th Ord Co (AB)
	15th Sig Pl (AB)
	Det 1st QM Co Avn Sup
	Pl Co G 30th QM Regt (Trk)
	Det 1st Chem Co Serv Avn
	Det Co A 83th QM Bn (LM)
	Det Finance
	Attached Medical

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MOSES LAKE, WASHINGTON

(Lat 47° 18' Long 119° 31')

Combat Units	Service Units (Sub-Air Base)
17th Recn Gp (H)	19th AB Gp (less AB Sq)
	731st Ord Co (AB)
	458th Ord Co Avn (B)
	44th Sig Pl (AB)
	Co B 33rd QM Regt (Trk) (less Det)
	Det 1st Pl Co B 91st QM Bn (Lt)
	Det 4th Chem Co Sup Avn
	Det 2nd QM Co Sup
	Det 434th Sig Co Maint Avn
	Det Finance
	Attached Medical

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EVERETT, WASHINGTON

(Lat 47° 54' Long 122° 17')

Combat Units	Service Units (Air Base)
Hq & Hq Sq 11th Pur Wg	34th AB Gp (less AB Sq)
(320th Sig Co Avn Wg)	708th Ord Co (AB)
54th Pur Gp (I)	678th Ord Co Avn (P)
83th Rec Sq (H)	23rd Sig Pl (AB)
	Det Co C 33rd QM Regt
	Det 2nd Pl Co B 91st QM Bn (LM)
	Det 4th Chem Co Sup Avn
	Det 2nd QM Co Sup
	16th Transport Sq
	Pl 453rd Ord Co Avn (B)
	Det 434th Sig Maint Co Avn
	Det Finance
	Attached Medical

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EVANS FIELD, FAIRWATER, WASHINGTON

(Lat 47° 41' Long 117° 20')

Combat Units	Service Units D. P.
Hq & Hq Sq 5th Bomb Wg	1 ZP fr 42nd AB Gp from Geiger Field
(314th Sig Co Air Wg)	

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FORT GEORGE WRIGHT, WASHINGTON

(Lat 47° 41' Long 117° 30')

Combat Units	Service Units P. P.
Hq & Hq Sq 2nd Air Force	Sub-Post of Geiger Air Base
(310th Sig Co Avn)	
(434th Sig Co Maint)	21st Engr Avn (less 2 Bns)

REMARKS

One Bn 21st Engr Avn to be stationed initially at Ft. Lewis, Wn.

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GEIGER AIR BASE, WASHINGTON

(Lat 47° 40' Long 117° 31')

Combat Units	Service Units (Air Base)
Hq & Hq Sq AFCC	42nd AB Gp (less AB Sq)
(30last Sig Co Avn)	39th Sig Pl (AB)
39th Bomb Gp (H)	727th Ord Co (AB)
	455th Ord Co Avn (B)
	Co M 30th QM Regt (Trk) (less Det)
	2nd Pl Co A 91st QM Bn (LM) (less Det)
	Det 4th Chem Co Serv Avn
	Det 2nd QM Co Avn Sup
	Det 434th Sig Co Maint Avn
	Det Finance
	Attached Medical

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HOQUIAM, WASHINGTON

(Lat 48° 11' Long 122° 09')

Combat Units	Service Units (Sub-Air Base)
31st Pur Gp (I)	46th AB Gp (less AB Sq)
	709th Ord Co (AB)
	679th Ord Co (P)
	24th Sig Pl (AB)
	Co B 30th QM Regt (Trk)(col)
	Det 2nd QM Co Sup Avn
	Pl Co A 88th Bn QM (IM)
	Det 1st Chem Co Serv Avn
	Det 432nd Sig Co Maint Avn
	Det Finance
	Attached Medical

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KITSAP COUNTY AIRPORT

(Lat 47° 31' Long 122° 47')

Combat Units	Service Units D. P.
59th Pur Sq (I)	1 DP fr 3rd AB Gp (R) from Olympia
	Pl 683rd Ord Co Avn (P)
	Det 1st Chem Co Serv Avn

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McCHORD AIR BASE, WASHINGTON

(Lat 47° 09' Long 122° 29')

Combat Units	Service Units (Air Base)
12th Bomb Gp (L)	44th AB Gp (less AB Sq)
19th Rec Sq (L)	29th Sig Pl (AB)
	716th Ord Co (AB)
	448th Ord Co Avn (B)
	Det Co M 30th QM Regt (Trk)
	Det Co B 91st QM Bn (LM)
	Det 4th Chem Co Serv Avn
	Det 2nd QM Co Sup Avn
	Det 434th Sig Co Maint Avn
	Pl 453rd Ord Co Avn (B)
	Det Finance
	Attached Medical

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MISSOULA, MONTANA

(Lat 46° 51' Long 114° 01')

Combat Units	Service Units (Air Base)
7th Bomb Gp (H)	5th AD Gp (less AB Sq)
	724th Ord Co (AB)
	453rd Ord Co Avn (B)
	Co A 91st QM Bn (LM) (less Det)
	Co D 30th QM Regt (Trk)(col) (less Det)
	30th Sig Pl (AB)
	Det 2nd QM Co Sup
	Det 4th Chem Co Sup Avn
	Det 434th Sig Maint Avn
	Det Finance
	Attached Medical

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OLYMPIA, WASHINGTON

(Lat 46° 58' Long 122° 54')

Combat Units	Service Units (Sub-Air Base)
Hq & Hq Sq 6th Pur Wg	3rd AB Gp (R) (less Det Hq & Hq Sq & 1 Mat Sq)
(315th Stg Co Air Wg)	30th Sig Pl (AB) (less Det)
52nd Pur Gp (I)	Co A 83th QM Bn (LM) (less Det)
	Co G 30th QM Regt (Trk) (less Det)
	695th Ord Co Avn (P)
	Det 1st Chem Co Serv Avn
	Det 432nd Sig Co Maint Avn
	114th Transport Sq
	Det Finance
	Attached Medical

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FORT WORDEN, WASHINGTON

(Lat 48° 7' Long 123° 29')

Combat Units	Service Units D. P.
39th Rec Sq (H)	DP fr 44th AB Gp
	Pl 442nd Ord Co Avn (B)
	Det 4th Chem Co Serv Avn

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SAND POINT (U.S.), WASHINGTON

(Lat 47° 41' Long 122° 16')

Combat Units	Service Units (Sub-Air Base)
33rd Pur Gp (I)	2nd AB Gp (R) (less 1 DP)
	683rd Ord Co Avn (P) (less 2 Pls)
	Det 38th Sig Pl (AB)
	Det Co C 30th QM Regt (Trk)
	Det Co A 89th QM Bn (LM)
	Det 1st Chem Co Serv Avn
	719th Ord Co Avn (AB)
	Det Finance
	Attached Medical

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MOSES LAKE, WASHINGTON

(Lat 47° 27' Long 120° 16')

Combat Units	Service Units (Sub-Air Base)
42nd Bomb Gp (M)	39th AB Gp (less AB Sq)
Hq & Hq Sq 90th Wg	705th Ord Co (AB)
(386th Sig Co Air Wg)	442nd Ord Co Avn (B)
	19th Sig Pl (AB)
	Det Co B 33rd QM Regt (Trk)
	Det 4th Chem Co Serv Avn
	Det Co C 68th QM Bn (LM)
	Det 2nd QM Co Sup
	Det Finance
	Attached Medical

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SECOND AIR FORCE

CONTENTS

QUARTERMASTER REQUIREMENTS

CLASS I	Supply (Rations and Gasoline, Fuel)
CLASS II	Tentage and Ranges, Field
CLASS III	Gasoline, Motor; Oil, Transmission; Oil, Motor; and Grease

Q.M. REQUIREMENTS

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HOSPITALIZATION AND EVACUATION

SECOND AIR FORCE

Troop Area	Troop Strength	Estimated Hospital Bed Requirement	Hospitalization Points	Estimated Beds Available	Method of Evacuation	Distance Miles
Missoula, Mont.	2412	120	Veterans Facility - Helena	31	By Ambulance	117
			Civil Hospital - Missoula	21	"	-
			Civil Hospital - Helena	27	"	117
			Civil Hospital - Butte, Mont. (5)	75	"	123
Spokane Area	4289	214	Fort George Wright, Wash.	200	"	5 - 8
Wenatchee, Wash.	6131	306	*Hospital Station at Ellensburg	250	"	77
Ellensburg, Wash.					"	-
Ephrata, Wash.					"	70
Aberdeen, Wash.	7054	352	McChord Field, Wash.	150	"	67
Olympia, Wash.			Fort Lewis, Wash.	150	"	20
McChord Field, Wash.						-
Boeing - Seattle	9142	457	Everett, Wash.	200	"	98 from Bellingham to Everett (farthest point)
Sandpoint - Seattle			Seattle - (Civil)	199	"	
Everett, Wash.			Bellingham - (Civil)	36	"	
Arlington, Wash.						
Bellingham, Wash.						
Kitsap County Airport	342	17	U. S. Navy Hospital, Bremerton, Wash.	50	"	15
Port Angeles, Wash.	443	22	Fort Worden, Wash.	22	"	50
TOTAL	29613	1468		1411		

*Obtain from Army.

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HOSPITALS

SECOND AIR FORCE AREA

I - U. S. Government.

Hospital	Location	Number of Beds
Station Hospital	Fort Lewis, Wash.	1500
" "	McChord Field, Wash.	150*
" "	Fort Lawton, Wash.	20
" "	Everett Air Base, Wash.	200*
" "	Fort Worden, Wash.	60*
" "	Fort George Wright, Wash.	200*
U. S. Navy	Bremerton, Wash.	308
U. S. Veterans Facility	Ft. Harrison, Helena, Mont.	154

II - Civil

"	Bellingham, Wash.	(2)	180
"	Everett, Wash.	(1)	114
"	Seattle, Wash.	(3)	996
"	Tacoma, Wash.	(2)	447
"	Wenatchee, Wash.	(2)	110
"	Spokane, Wash.	(3)	645
"	Olympia, Wash.	(1)	100
"	Aberdeen, Wash.	(1)	60
"	Port Angeles, Wash.	(2)	137
"	Ellensburg, Wash.	(2)	40
"	Butte, Montana	(3)	377
"	Helena, Montana	(2)	139
"	Missoula, Montana	(1)	102

* Expanded.

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MEDICAL SUPPLY

SECOND AIR FORCE

The Medical Supply Section (Off 2 EM 19) will be located at Geiger Field (Spokane). This unit will have in stock sufficient replacements of medical supplies for the forward unit Aid Stations for ten days.

A thirty day stock of replacements will be placed to the credit of this Air Force in the Ogden Depot and will be shipped by rail from that Depot on request.

Distribution: Distributing points will be established at McChord Field and Everett Air Base for the coastal area. DP personnel (attached from the Medical Supply Section) will operate the medical section of these DPs and will deliver supplies by truck to Aid Stations in their respective areas. All units south of and including Sandpoint will be supplied by the McChord DP and all units north of that point will be supplied by the Everett DP. The Wenatchee-Ellensburg-Ephrata stations will be supplied from the sub-DP established at Ellensburg.

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ESTIMATED AMOUNT OF CLASS 4 (EXPENDABLE MEDICAL SUPPLIES)

REQUIRED FOR 10 DAYS FOR 20,000 TROOPS IN THE AIR FORCE SERVICE AREA

NO.	ITEM	UNIT	Based on 20,000 TROOPS FOR 10 DAYS
10060	Acetophenetidin 5 gr tab	1000	2
10100	Acid, acetylsalicylic 5 gr	1000	14
10400	Acid, tannic	¼ lb	4
10490	Alcohol (ethyl)	5 gal	7
10520	Alcohol, denatured	5 gal	7
10570	Aloin compound pill or tab	1000	6
10600	Ammonia aromatic spirits	Pint	11
10660	Ammonium Chloride troches	1000	3
10730	Apomorphine hydrochloride 1/10 gr	20	2
10860	Atropine sulfate 1/100 gr	20	8
11100	Caffeine with sodium benzoate	100	2
11290	Cascara sagrada extract 2 gr	1000	2
11490	Codeine sulfate ½ gr tab	500	7
11505	Compound cathartic pill or tab	1000	3
11555	Coryza tablets	100	3
11675	Digitalis hypo sol. 1 amp. equal 1 cat unit	Doz	27
11760	Epinephrine soluble salt 3/200 gr tab	20	30
11790	Ether (for anesthesia)	1/4 lb	260
11800	Ethyl chloride	3 oz	12
11840	Eugenol	Oz	4
12040	Foot Powder	1/4 lb	160

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12190	Glycerin	10 lb	3
12230	Glycerin & opium comp	1000	2
12280	Homatropine hydrobromide	15 gr	2
12410	Ipecac and opium powder 5 gr tab	500	3
12550	Litmus paper, blue strips indicator	100	6
12560	Litmus paper, red strips	100	3
12650	Magnesium sulfate	50 lb	2
12750	Mercuric oxide, yellow ointment	1/4 oz	21
12854	Mercury bichloride, large poison tab	250	12
12955	Morphine sulfate 1/4 gr hypo tab	20	16
13350	Petrolatum	10 lb	2
13396	Phenobarbital 1/2 gr tab	100	3
13370	Potassium permanganate 5 gr tab	100	6
13840	Procaine hydro, and epinephrine tab	20	48
13910	Quinine sulfate 5 gr tab	1000	8
14050	Silver nitrate	Oz	4
14160	Sodium bicarbonate	10 lb	2
14180	Sodium bicarbonate and pepper mint tab	1000	4
14637	Sulfanilamide 5 gr tab	1000	4
14641	Sulfathiazol, 7.7 gr tab	1000	3
14910	Whiskey	Quart	20

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CLASS NO. 2

20090	Bandage, muslin, 5 inch	Doz	5
20130	Cotton, absorbent, compressed	Oz	35
20140	Cotton, absorbent, roll	Lb	200
20240	Gauze, plain, sterilizer	Pkg	45
20300	Packet, first-aid	Each	148
20340	Plaster, adhesive, 1 inch	Spool	136
20350	Plaster, adhesive, 3 inch	Spool	245

CLASS NO. 3

31070	Catheter, urethral, rubber 14 F	Each	6
31080	Catheter, urethral, rubber 16 F	Each	4
31090	Catheter, urethral, rubber 18 F	Each	2
31100	Catheter, urethral, rubber 22 F	Each	6
36110	Applicator, wood	Ctn	2
36160	Bag, politzer	Each	2
36680	Depressor, tongue, wood	Ctn	60
36830	Gloves, medium, size 7-1/2	Pair	12
36840	Gloves, medium, size 8	Pair	6
37147	Perimeter, charts, Schweigger left	Pkg	2
37148	Perimeter, charts, Schweigger right	Pkg	2
37160	Pin, white head	Each	6
37210	Razor, safety, blades	Pkg	12
37356	Splint, basswood.	Set	3

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37455	Splint, strap	Each	2
37540	Splint, wire, ladder	Each	2
37800	Suture, catgut, chromic size 2	Tube	20
37850	Suture, catgut, plain, size 0	Tube	56
37860	Suture, catgut, plain, size 1	Tube	56
37870	Suture, catgut, plain , size 2	Tube	72
37880	Suture, catgut, plain, size 3	Tube	30
38190	Syringe, hypodermic, needle 3/4"	Doz	2
38440	Syringe, Luer, 2 cc	Each	6
38450	Syringe, Luer, 10 cc	Each	4
38470	Syringe, Luer, needle 25 gauge 1/4 inch canula	Doz	2
38490	Syringe, Luer, needle 23 gauge 3/4 inch canula	Doz	6
38510	Syringe, Luer, needle 19 gauge 1-3/4 inch canula	Doz	2
38520	Syringe, Luer, needle, 17 gauge 3 inch canula	Doz	2
38610	Syringe, urethral, prophylaxis	Each	60
38750	Tube, stomach	Each	2

CLASS NO. 4

40315	Beaker, 50 cc	Each	2
40490	Bottle, narrow mouth, 30 cc	Each	4
40580	Bottle, wide mouth, 50 cc cork finish	Each	3
40590	Bottle, wide mouth, 120 cc cork finish	Each	3
42610	Funnel, glass 50 mm	Each	1

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CLASS NO. 4 CONT'D

43580	Paper, filter, 90 mm	Pkg	3
43670	Pipette, Ostwald	Each	2
44320	Test tube, culture	Each	100
44700	Urinometer	Each	2

CLASS NO. 5

50610	Bur, No. 1/2, straight handpiece	Pkg	2
50630	Bur, No. 2, straight handpiece	Pkg	2
50650	Bur, No. 6, straight handpiece	Pkg	2
51200	Cement, germicidal	Box	3
51680	Cleaners, No. 2	Pkg	2
56960	Wire, brass, ligature	Box	1

CLASS NO. 7

74560	Brush, hand	Each	16
74930	Soap, white, floating	Bar	250
75040	Bag, paper, 5 pounds	Pkg	2
75150	Book, blank, 8 VO	Each	16
75360	Clip paper, Gem, No. 1	Box	18
75400	Envelope, No. 189	Pkg	100
75420	Envelope, No. 36	Pkg	10
75430	Envelope, No. 84	Pkg	10
75460	Eraser, soft rubber	Each	8
75470	Eraser, rubber, typewriter	Each	8
75750	Label, 1-5/8 x 1-11/16 inch	Box	6
75870	Mucilage, 4 oz	Bot	3
75940	Pad, prescription	Each	56

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CLASS NO. 7 CONT'D

75960	Pad, memorandum, 6 x 9 inches	Each	56
75970	Pad, memorandum, 8 x 10½ inches	Each	56
76020	Paper, blotting, 3 x 9½ inches	Piece	277
76040	Paper, carbon, black 8 x 10½ inches	Box	16
76100	Paper, typewriter, bond, 8 x 10½ inches	Ream	26
76110	Paper, typewriter, manifolding 8 x 10½ inches	Ream	26
76240	Pencil lead	Doz	2
76250	Pencil, blue	Each	6
76270	Pencil, indelible	Each	6
76280	Pencil, red	Each	6
76310	Penholder	Each	16
76370	Ribbon Typewriter	Each	3
76580	Tack, thumb	Box	2
76590	Tag, shipping, linen	Each	72
77240	Box, ointment, 3 in nest	Doz	26
77280	Box, table, folding	500	26
77780	Cup paper	Ctn	83
77350	Droppers, medicine	Doz	7
78680	Paper, toilet	Roll	200
78760	Pin, common	Paper	20
78770	Pin, safety, large	Card	83
78780	Pin, safety, medium	Card	83
79230	Strap and buckle	Each	2
79290	Tape measure, 60 inches	Each	2

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CLASS NO. 7 CONT'D

79320	Thermometer clinical	Each	176
79360	Towel, paper	Pkg	110
79460	Vial 1 oz	Doz	18

CLASS NO. 9

91010	Acid, boric, ointment	Tube	60
91015	Acid, salicylic, ointment 1 oz	Tube	60
91018	Acid, Tannic, ointment, with chlorbutanol 1/2 oz	Tube	60
91025	Ammonia, aromatic, 5 Min	Box	18
91030	Bismith, subcarbonate 5 gr tab	Bot	6
91070	Cocaine, hydrochloride 2 gr hypo tab	Tube	4
9110	Iodine, 15 gr and potassium iodide 22.5 gr	Box	48
91120	Iodine Swab 1½ cc	Box	90
91122	Iodine swab 10 min	Box	48
91140	Mercurial ointment, mild ½ oz	Tube	48
91145	Mercuric ointment, ammoniated 1 oz	Tube	48
91150	Mercurous chloride ointment 1oz	Tube	48
91190	Protein silver, mild 4-6/10 gr tab	Bot	18
91200	Protein silver, strong 4-6/10 gr tab	Bot	18
91215	Sulfur ointment, 1 oz	Tube	48
91230	Zinc oxide, ointment 1 oz	Tube	48
92000	Bandage, gauze, adhesive 1 x 3½ inch	Each	1200

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CLASS NO. 9 CONT'D

92004	Bandage, gauze, compress, 2 x 2 inch	Each	1200
92010	Bandage, gauze, compressed 3 inch	Box	14
92030	Bandage, plaster of paris	Doz	20
92040	Bandage, triangular, compressed	Each	72
92050	Dressing, first-aid, large	Pkg	1200
92060	Dressing, first-aid, small	Pkg	800
92070	Gauze, sublimated	Pkg	250
99055	Bands, rubber, assorted	Ctn	4
99105	Book, note, 2½ inch	Each	6
99110	Book, note, manifolding, binder	Each	6
99115	Book, note, manifolding, filler	Each	6
99225	Cup paper noncollapsible	Each	700
99295	Ink, powder, black	Tube	6
99435	Pen, steel, assorted	Doz	4
99605	Vial, glass, 60 cc	Each	24
99610	Vial, glass, stoppers	Each	48

BLANK FORMS

52b	Emergency Medical Tag	Book	36
77	Venereal prophylaxis slip	Each	1200

QUARTERMASTER PROPERTY

Calcium hypochlorite	Tube	1200
Orthotolodine	Tube	1000

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Estimated weight of expendable Medical Supplies, listed hereon, for the Air Force Service Area (Including packing and crates) . . . . . .5000 lbs

Displacement, including packing and crates (This is based on approximately 33 boxes, each weighing 150 pounds, with outside dimensions of each box being 18" deep x 24" wide x 36" in length) . . . . . 297 Cu. Ft.

Supplies listed hereon to be shipped to the Medical Supply Officer of the Medical Supply Section,

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ORDNANCE SUPPLY REQUIREMENTS

ALL ARMY FORCES

(SEE ORDNANCE PLAN IN FOLDER)

ORDNANCE REQUIREMENTS

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CHEMICAL WARFARE SUPPLY REQUIREMENTS

TEN (10) DAY INITIAL OPERATIONAL PERIOD

SECOND AIR FORCE SERVICE AREA

CHEMICAL REQUIREMENTS

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CHEMICAL REQUIREMENTS

SECOND AIR FORCE SERVICE AREA

TEN (10) DAY INITIAL OPERATIONAL PERIOD

CHEMICAL WARFARE SUPPLY REQUIREMENTS

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		AIR BASES								SUB AIR BASES								D. P.			
		MISSOULA		GEIGER		MC CHORD		EVERETT		WENATCHEE		ELLENSBURG		BELLINGHAM		SANDPOINT		PT. ANGELES			
	ITEM	NO.	WT.	NO.	WT.	NO.	WT.	NO.	WT.	NO.	WT.	NO.	WT.	NO.	WT.	NO.	WT.	NO.	WT.	RECAP.	REMARKS
(1)	ALARM, GAS	5	50	18	180	11	110	18	180											No. 52 Wt. 520 lbs.	Maintenance stock - 10% of mobilization issue.
(2)	APPARATUS, RESCUE, OXYGEN, 4-GALLON PRESSURE TYPE	10	300	44	1320	26	780	44	1320											No. 124 Wt. 3,720 lbs.	Maintenance stock - 10% of mobilization issue.
(3)	APPARATUS, RESCUE, OXYGEN, 1½-QUART CAPACITY	13	153	51	348	32	384	54	648											No. 153 Wt. 1,836 lbs.	Maintenance stock - 10% of mobilization issue.
(4)	APPARATUS, RESCUE, POWER DRIVEN	1	5000	1	5000	1	5000	1	5000											No. 4 Wt. 20,000 lbs.	Maintenance stock - 10% of mobilization issue.

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	ITEM	AIR BASES: MISSOULA NO.	MISSOULA WT.	GEIGER NO.	GEIGER WT.	MC CHORD NO.	MC CHORD WT.	EVERETT NO.	EVERETT WT.	SUB AIR BASES: WENATCHEE NO.	WENATCHEE WT.	ELLENSBURG NO.	ELLENSBURG WT.	BELLINGHAM NO.	BELLINGHAM WT.	SANDPOINT NO.	SANDPOINT WT.	D. P. PT. ANGELES NO.	PT. ANGELES WT.	RECAP.	REMARKS
(5)	CANISTER, COLLEC. PROTECTOR, M1	2	100	7	350	4	200	7	350											No. 20 1,000 lbs.	Maintenance stock - 10% of mobilization issue.
(6)	COLLECTIVE PROT. FILT., M1	1	300	3	900	2	600	3	900											No. 9 2,700 lbs.	Maintenance stock - 5% of mobilization issue.
(7)	CURTAIN GAS-PROOF	9	45	30	150	17	85	30	150											No. 86 430 lbs.	Maintenance stock - 10% of mobilization issue.
(8)	IMPREGNITE, SHOE (TUBES)	1880	470	6270	1317	3760	940	6270	1317											No. 18,180 Wt. 4,044 lbs.	Complete mobilization issue of one (1) tube per man plus 10% maintenance stock.

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		AIR BASES								SUB AIR BASES								D. P.				
		MISSOULA		GEIGER		MC CHORD		EVERETT		WENATCHEE		ELLENSBURG		BELLINGHAM		SANDPOINT		PT. ANGELES				
	ITEM	NO.	WT.	NO.	WT.	NO.	WT.	NO.	WT.	NO.	WT.	NO.	WT.	NO.	WT.	NO.	WT.	NO.	WT.	RECAP		REMARKS
(9)	KIT, REPAIR MASK, COMPANY	3	2	10	5	6	3	10	5											No. 29 Wt. 15 lbs.		Maintenance stock - 2% of mobilization issue.
(10)	KIT, REPAIR, MASK AUXILIENTAL	1	25	3	75	2	50	3	75											No. 9 Wt. [illegible] lbs.		Maintenance stock - 2% of mobilization issue.
(11)	MASK, GAS SERVICE	175	1750	583	5830	350	3500	583	5970											No. 1,691 Wt. 16,910 lbs.		Maintenance stock - 10% of mobilization issue.
(12)	OINTMENT PROTECTIVE, TUBE	170	43	570	143	340	85	570	143											No. 1,650 Wt. 414 lbs.		Maintenance stock - 10% of mobilization issue.

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		AIR BASES								SUB AIR BASES								D. P.				
		MISSOULA		GEIGER		MC CHORD		EVERETT		WENATCHEE		ELLENSBURG		BELLINGHAM		S. HEDGING		PT. ANGELES				
	ITEM	NO.	WT.	NO.	WT.	NO.	WT.	NO.	WT.	NO.	WT.	NO.	WT.	NO.	WT.	NO.	WT.	NO.	WT.	RECAP.		REMARKS
(13)	TANKS, AIRPLANE SPRAY					2300	115,000													No. 2,300 Wt. 115,000 lbs		4 tanks per BB (L) and Rec (L) plane per day plus 10% maintenance stock. Tanks to be jettisoned after each attack.
	TOTAL CLASS VI SUPPLIES		8241 4.2 T.		15918 7.9 T.		126,737 63.3 T.		15918 7.95 T.													166,814 83.4 Tons
	NOTE: Protective clothing both of the impregnated and impervious type are stored and issued by the Quartermaster Corps. Assumption: All units and individuals have been issued complete clothing prior to movement into the theatre of operation.																					
(14)	SMOKE LIQUID (FS)					41,600 g. 328 T.														No. 328 Tons Wt.		One mission per BB (L) and Recon (L) plane per day. (80 gallons)
(15)	AGENT, DEMUSTARD., POWDER BLEACH		5.5 T.		17 T.		53 T.		43 T.		11.5 T.		28 T.		33 T.		35 T.		7 T.	No. 233 Tons Wt.		5 fillings each per authorized decon. app. at pursuit stations; 2 fillings each at BB (L) stations; 1 filling each at all others.

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	ITEM	AIR BASES: MISSOULA NO.	MISSOULA WT.	GEIGER NO.	GEIGER WT.	MC CHORD NO.	MC CHORD WT.	EVERETT NO.	EVERETT WT.	SUB AIR BASES: WENATCHEE NO.	WENATCHEE WT.	ELLENSBURG NO.	ELLENSBURG WT.	BELLINGHAM NO.	BELLINGHAM WT.	SANDPOINT NO.	SANDPOINT WT.	D. P.: PT. ANGELES LO.	PT. ANGELES WT.	RECAP.	REMARKS
(16)	AGENT, DEMUSTARD POWDER, NON-CORR		54		181		108		181											No. Wt. 524 lbs.	One complete refill per each app., 1½-qt., as authorized for motor vehicles and airplanes.
(17)	AGENT, DEMUSTARD SOLVENT, NON-CORR		813		2710		1626		2710											No. Wt. 7,6[illegible] lbs.	One complete refill per each app., 1½-qt., as authorized for motor vehicles and airplanes.
	TOTAL CLASS X SUPPLIES	11,867		36,801		763,734		88,801		23,000		56,000		66,000		70,000		14,000			1,130,383
	TONS	5.9		18.5		381.8		44.5		11.5		28.0		33.0		35.0		7.0			565 Tons
	TOTAL ALL CW SUPPLIES	20,108		52,809		890,471		104,809		23,000		56,000		66,000		70,000		14,000			1,297,197
	TONS	10.1		26.4		445.2		52.4		11.5		28.0		33.0		35.0		7.0			648.4 Tons

NOTE: Delivery period in days estimated at M + 21 for points east of the Coast Range and M + 25 for points west of the Coast Range.

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ENGINEER REQUIREMENTS

ENGINEER SUPPLY REQUIREMENTS

TEN (10) DAY INITIAL OPERATING PERIOD

SECOND AIR FORCE SERVICE AREA

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1. The items of the enclosed table are indicated as stocks at the Engineer re-filling points at Everett and McChord Air Bases. It is assumed that a ground force Engineer depot will be established at Tacoma or Seattle, and certain of the above items would be carried as credit items in this depot. A large amount of the heavy construction material would not be carried either in the depot or re-filling points, but would be stocked in convenient dumps. Therefore, the table represents requirements rather than stocks to be carried.

2. There is no basis for determining amounts of Engineer Class IV supplies required. It is assumed that the initial demand will be for materials required for the construction of airplane revetments, strong points, and command post shelters for protection at exposed air bases, and materials required for runway maintenance and camouflage. The estimate of materials is based on this assumed initial demand.

3. The amount of Class II Engineer supplies is based on a replacement of approximately 10% of allowances as prescribed in TDA. The special equipment listed is for initial issue to the Engineer organization operating in the Second Air Force Area.

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CLASS II SUPPLIES

	Item	Everett R P No.	McChord R P No.	Total No.
1.	Board, drawing	1	1	2
2.	Carpenter equipment, platoon set, complete with supplies	3	3	6
3.	Carpenter equipment, squad set, complete with supplies		3	3
4.	Compass, watch	10	20	30
5.	Compass, prismatic	10	10	20
6.	Demolition equipment, platoon, set, complete with supplies		1	1
7.	Demolition equipment, squad set, complete with supplies		3	3
8.	Drafting equipment, regimental, set, complete with supplies		1	1
9.	Drafting equipment, battalion, set, complete with supplies	1		1
10.	Drafting equipment, company, set, complete with supplies	1	2	3
11.	Electric lighting equipment	1	2	3
12.	Glasses, reading	3	3	6
13.	Knife, pocket, engineer		50	50
14.	Mixer, concrete		1	1
15.	Pens, lettering, set	1	1	2
16.	Planimeter		1	1
17.	Pioneer equipment, platoon, set, complete with supplies		1	1
18.	Pioneer equipment, squad, set, complete with supplies		3	3
19.	Rule, 6 foot		10	10
20.	Saw, timber		1	1
21.	Stereoscope with binoculars	3	3	6
22.	Stools, drafting	2	2	4

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CLASS II SUPPLIES

SPECIAL EQUIPMENT

	Item	McChord R P No.
1.	Grader, road, leaning wheel type	1
2.	Plow, disc, heavy	3
3.	Plow, tractor	3
4.	Roller, sheeps foot, triple unit	1
5.	Rooter, heavy	1
6.	Rooter, medium	1
7.	Scraper, wheeled, 8 yd.	3
8.	Tank, water storage, 500 gal. trailer	3
9.	Tractor, crane 30' boom	1
10.	Tractor, diesel, 70 H.P.	3
11.	Trailer, 8-ton	2
12.	Trailer, 15-16-ton	3
13.	Welding equipment electric arc and oxyacetylene	1

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CLASS IV SUPPLIES

(Major Items)

Item	Everett R P No.	Everett R P Wt.	McChord R P No.	McChord R P Wt.
1. Bags, burlap, sand	60,000	10 T	60,000	10 T
2. Cement	4,000 bbls.	600 T	4,000 bbls.	600 T
3. Corrugated iron	30,000 sq. ft	20 T	30,000 sq. ft.	20 T
4. Explosives		1 T		1 T
5. Fishnets	100	6 T	100	6 T
6. Lumber	1,000,000 ft. B M	2000 T	1,000,000 ft. B M	2000 T
7. Nails		5 T		5 T
8. Picks	500	2 T	500	2 T
9. Pickets, long	1,600	8 T	1,600	8 T
10. Pickets, short	3,200	8 T	3,200	8 T
11. Reinforcing bars		100 T		100 T
12. Shovels	1,000	2 T	1,000	2 T
13. Wire, barbed, coils	400	20 T	400	20 T
14. Wire, smooth, coils	100	5 T	100	5 T
Total Wt.		2787 T		2787 T

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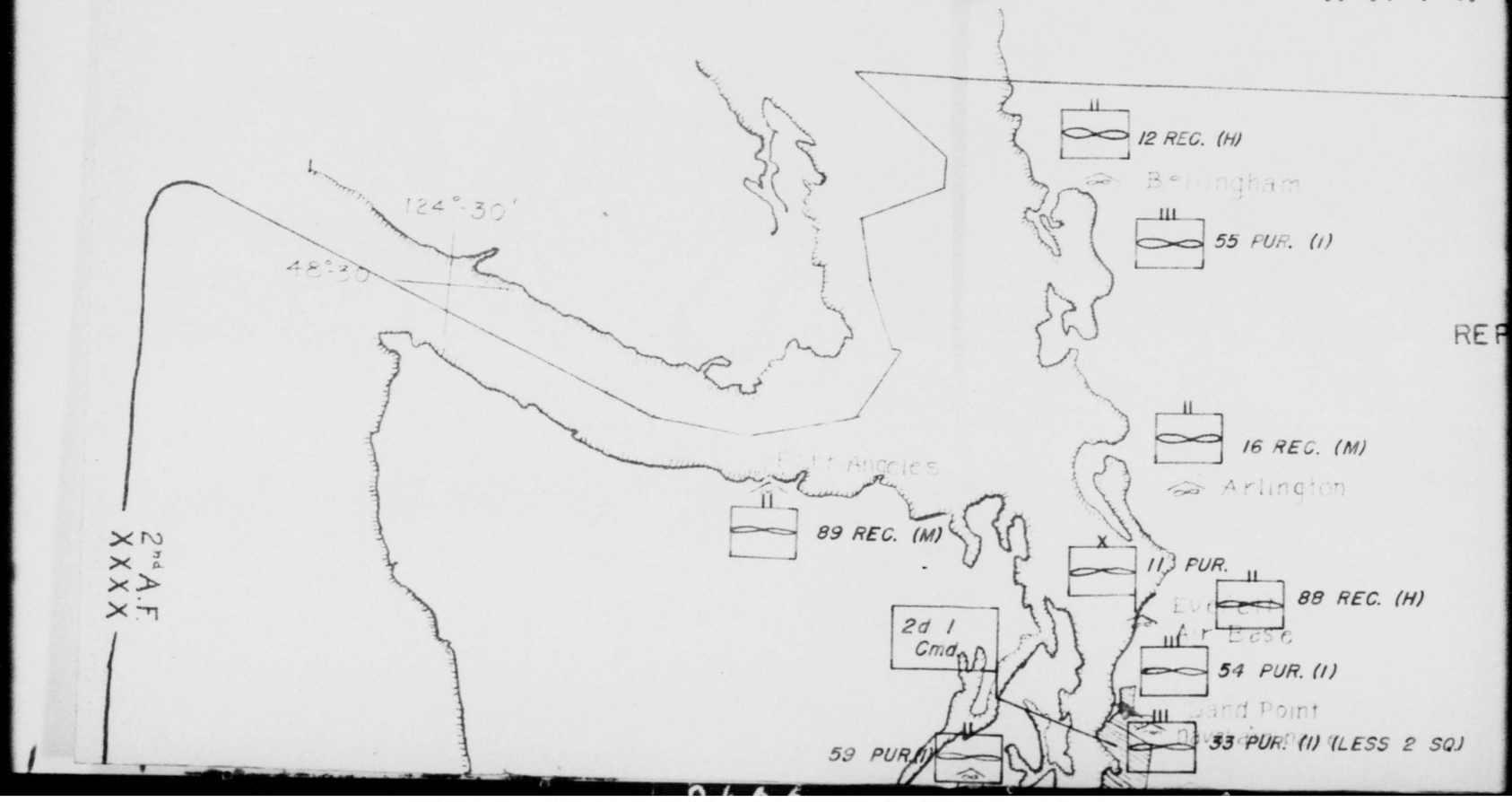

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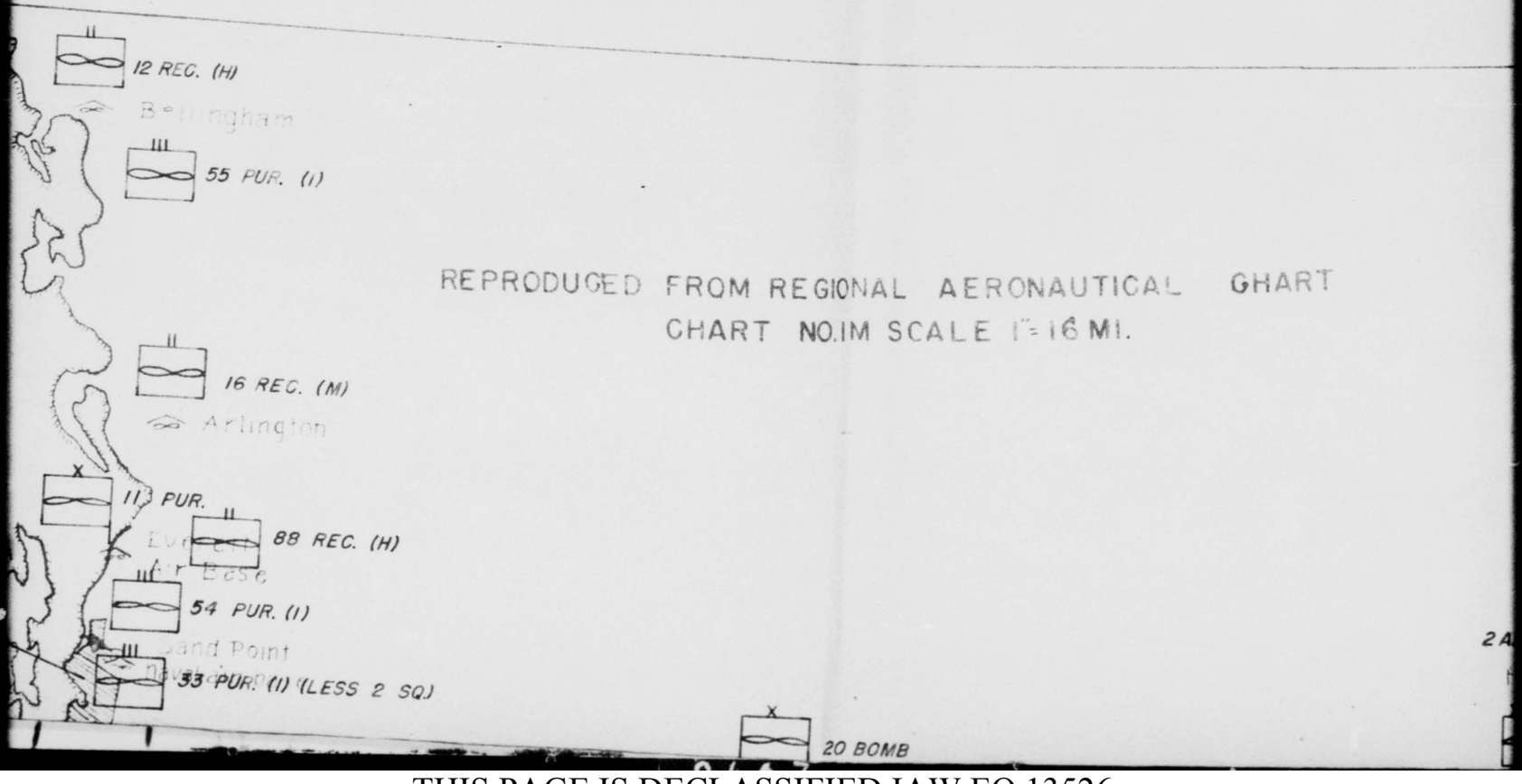

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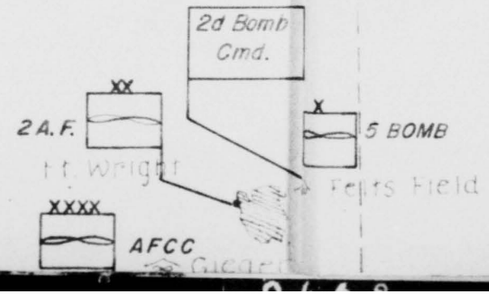

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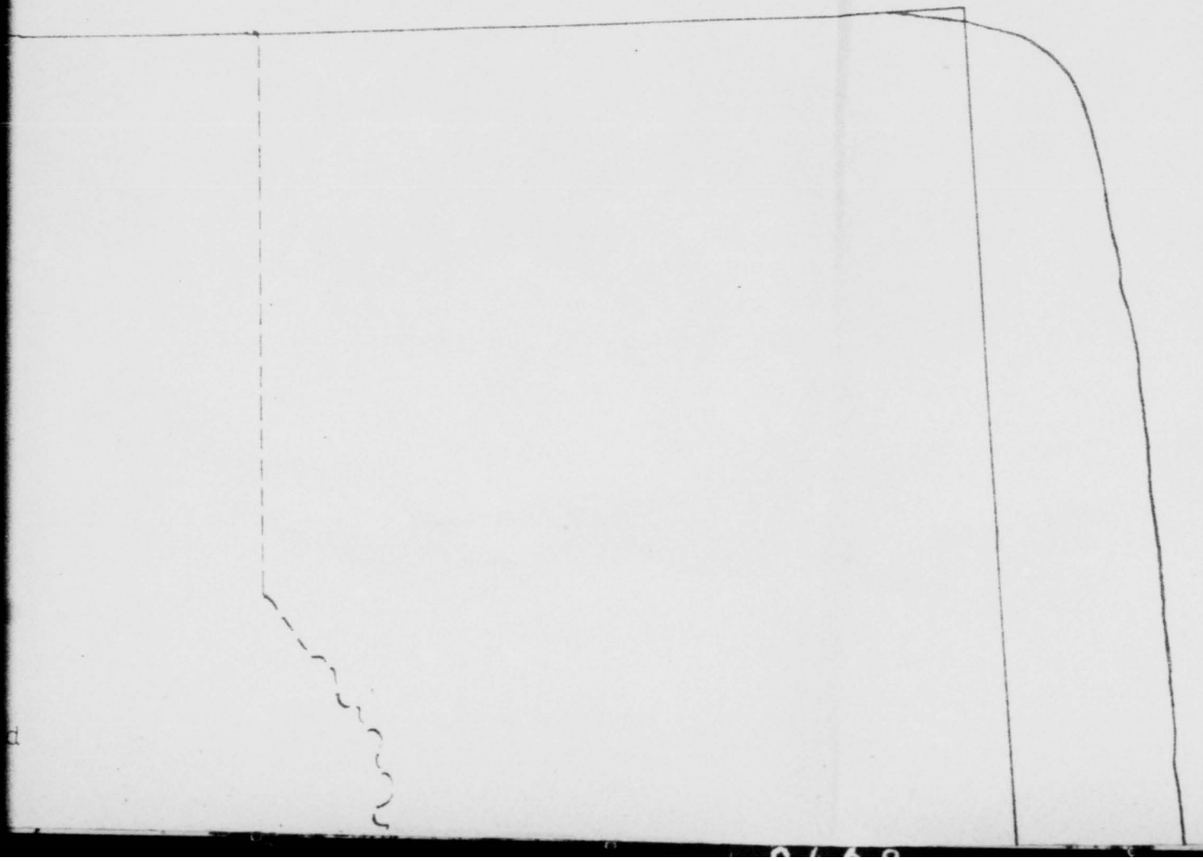

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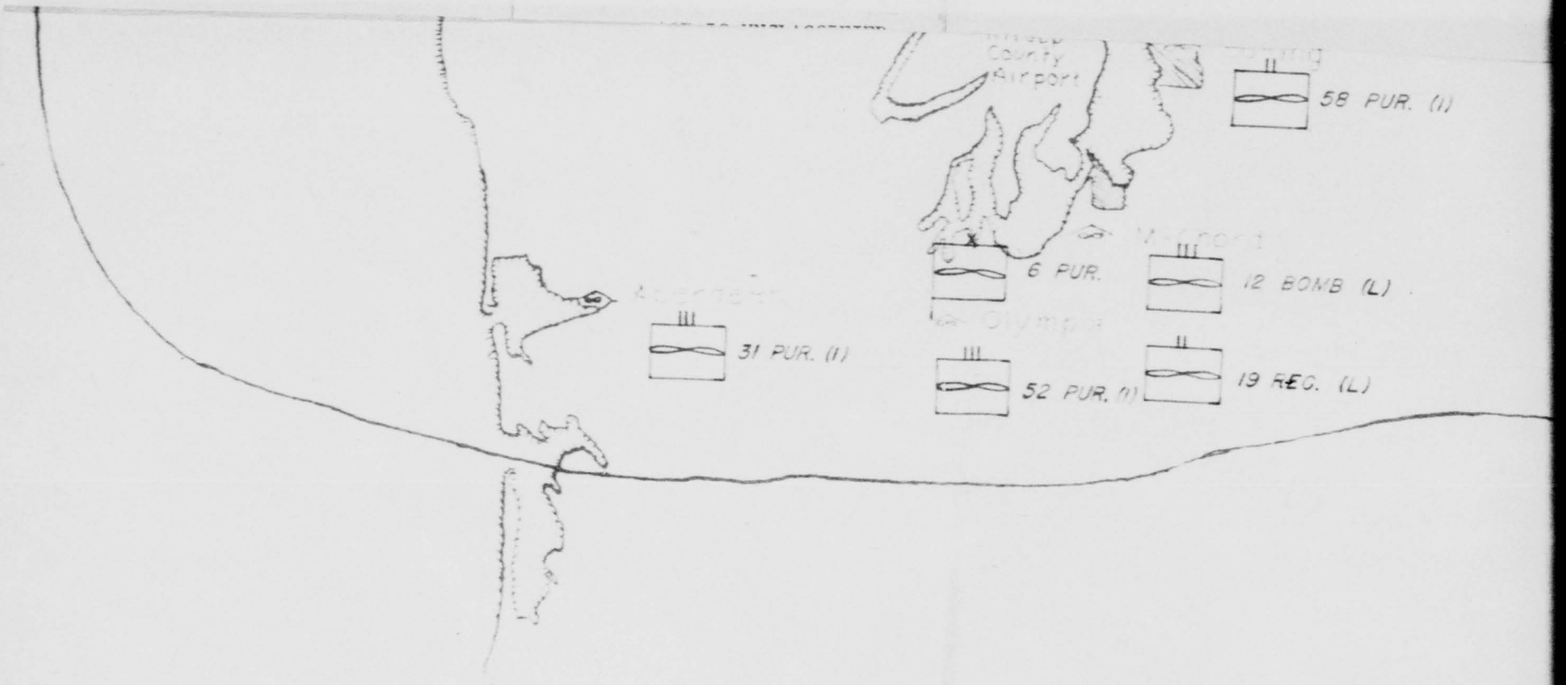

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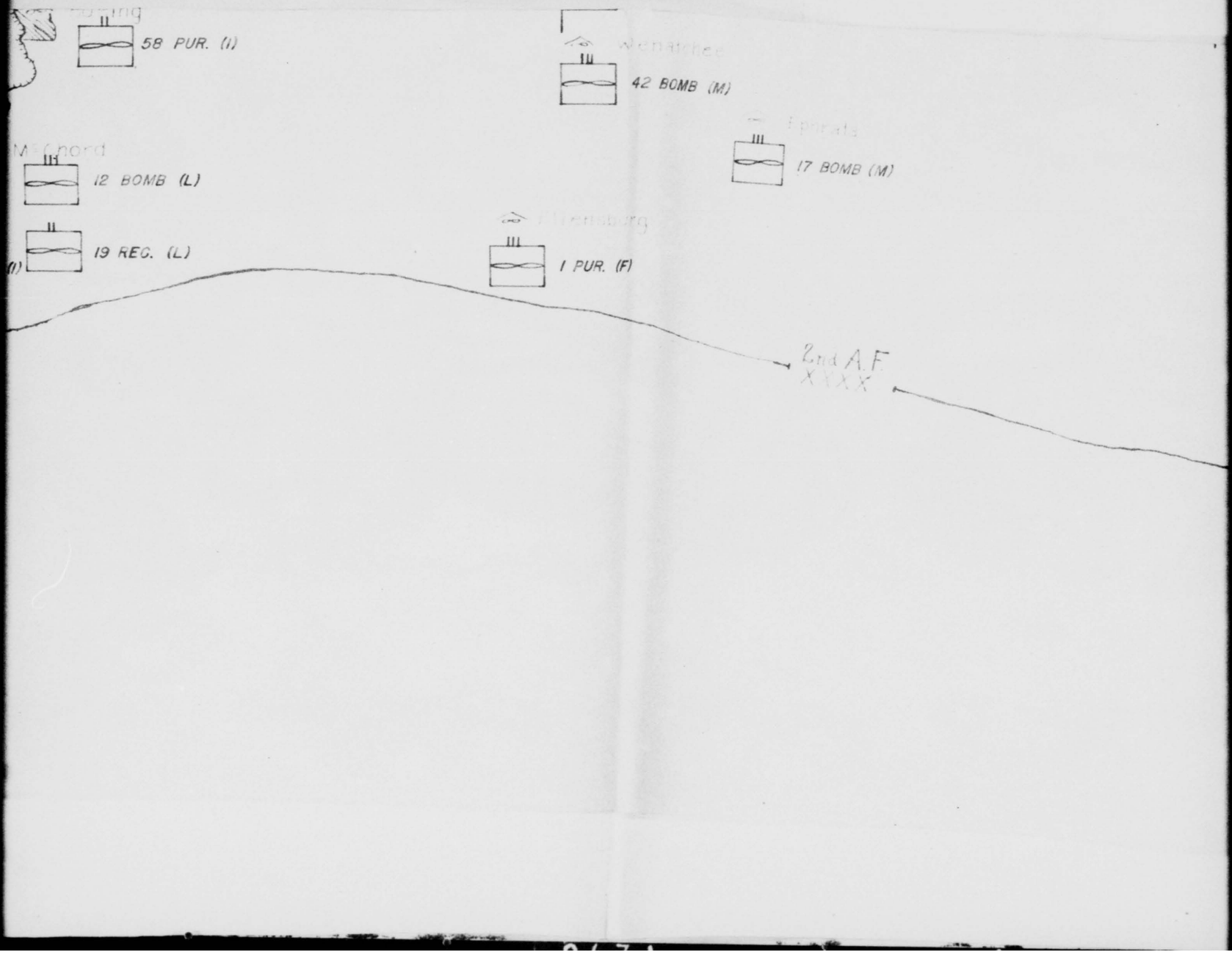

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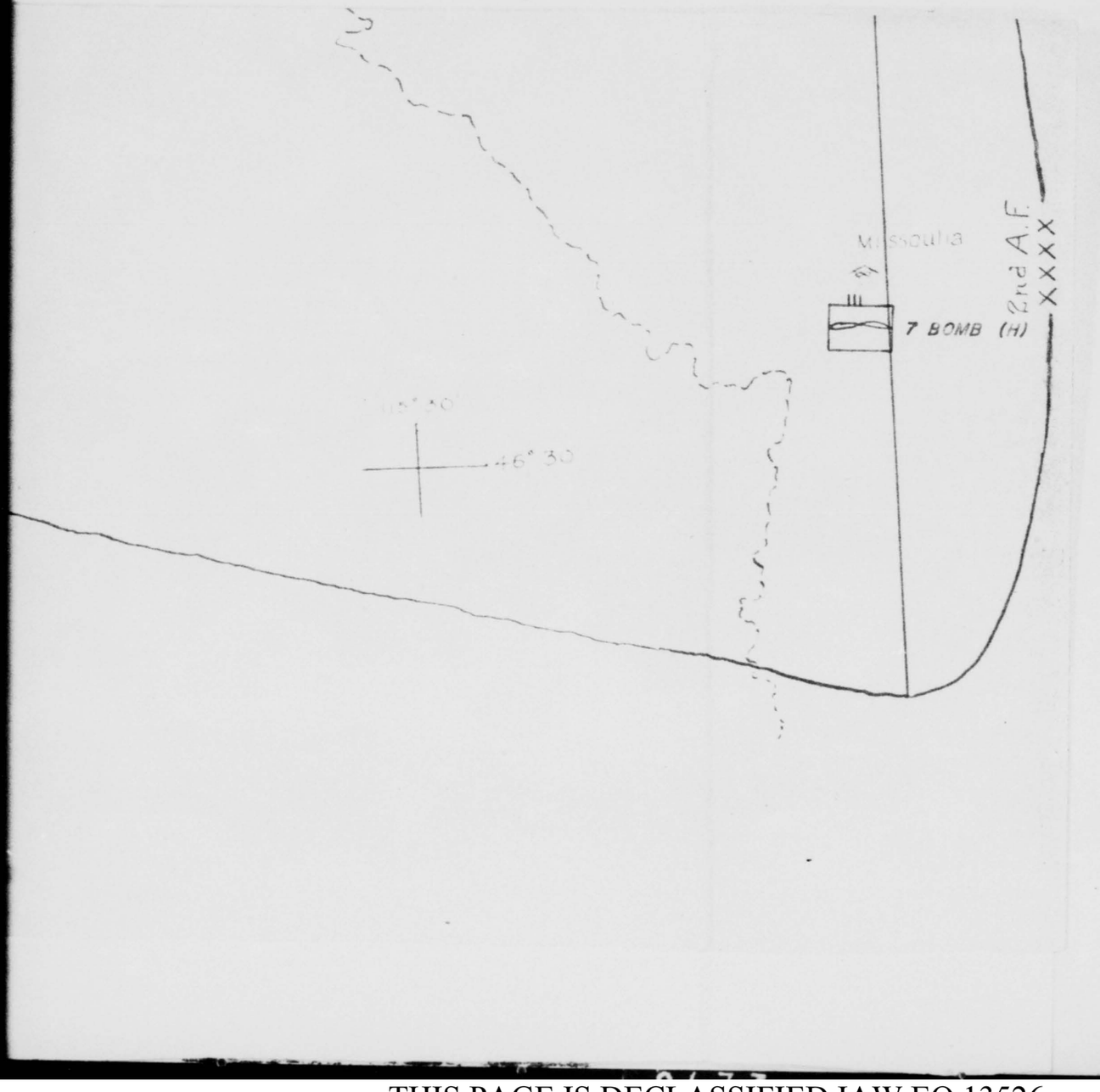

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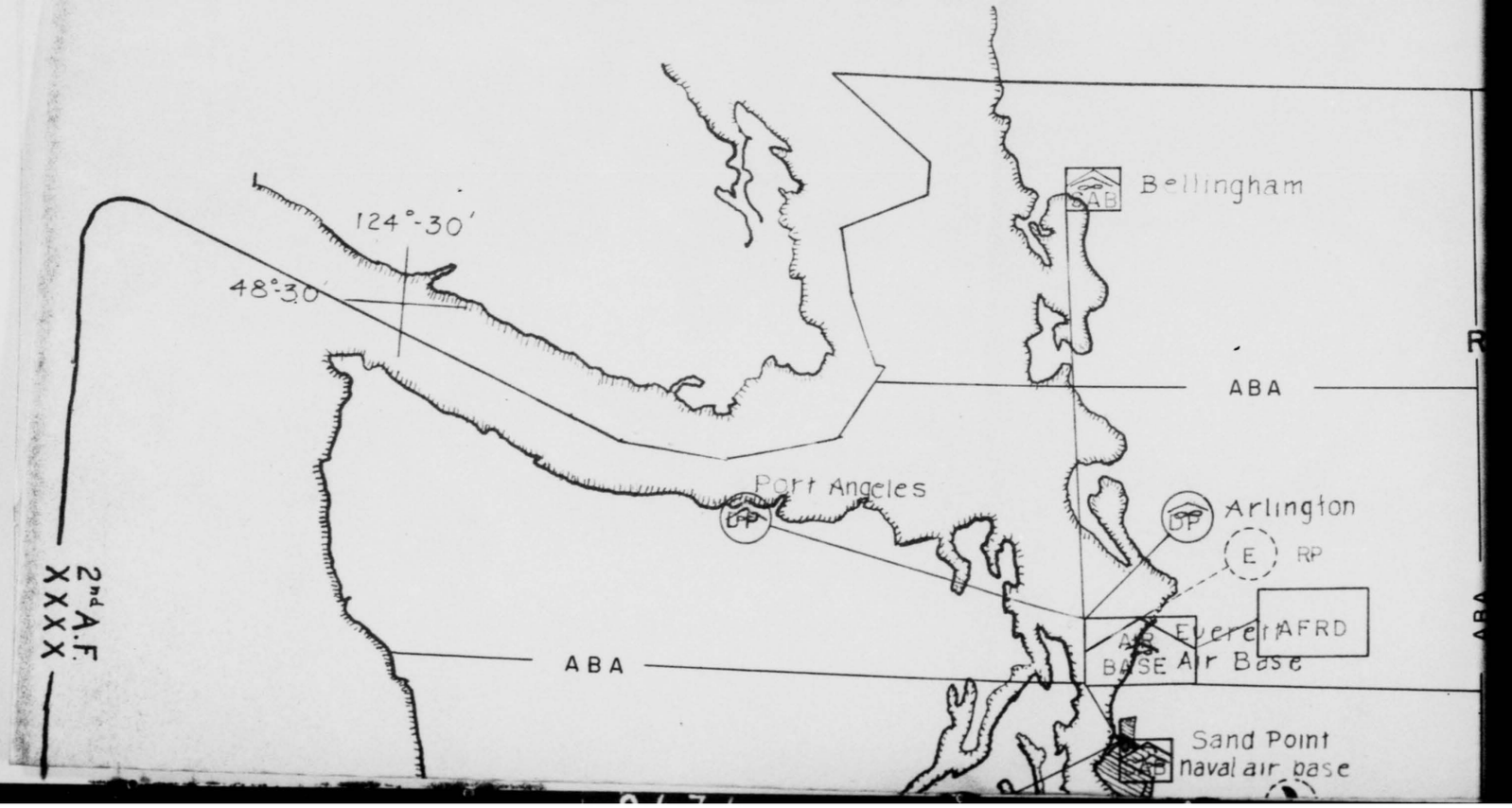

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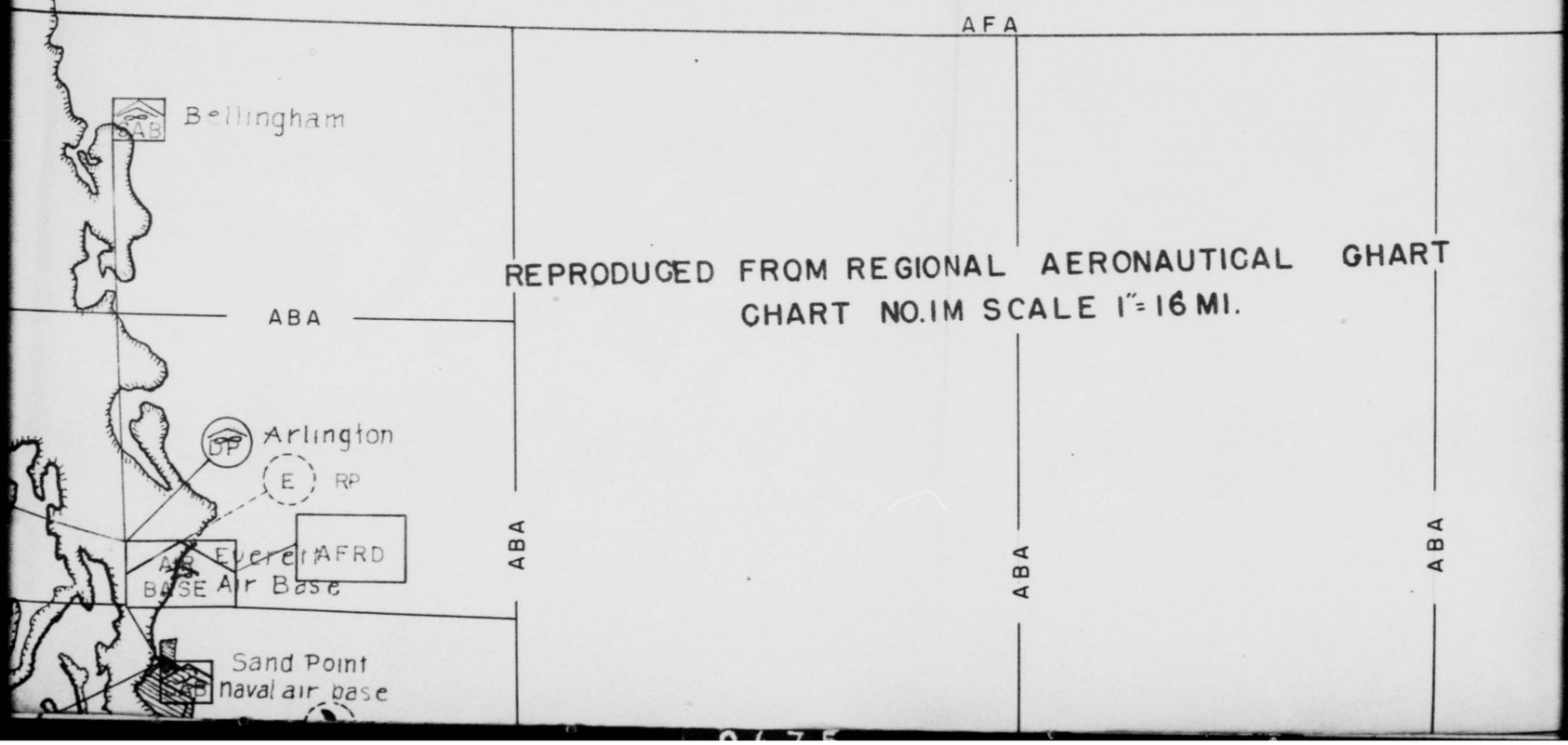

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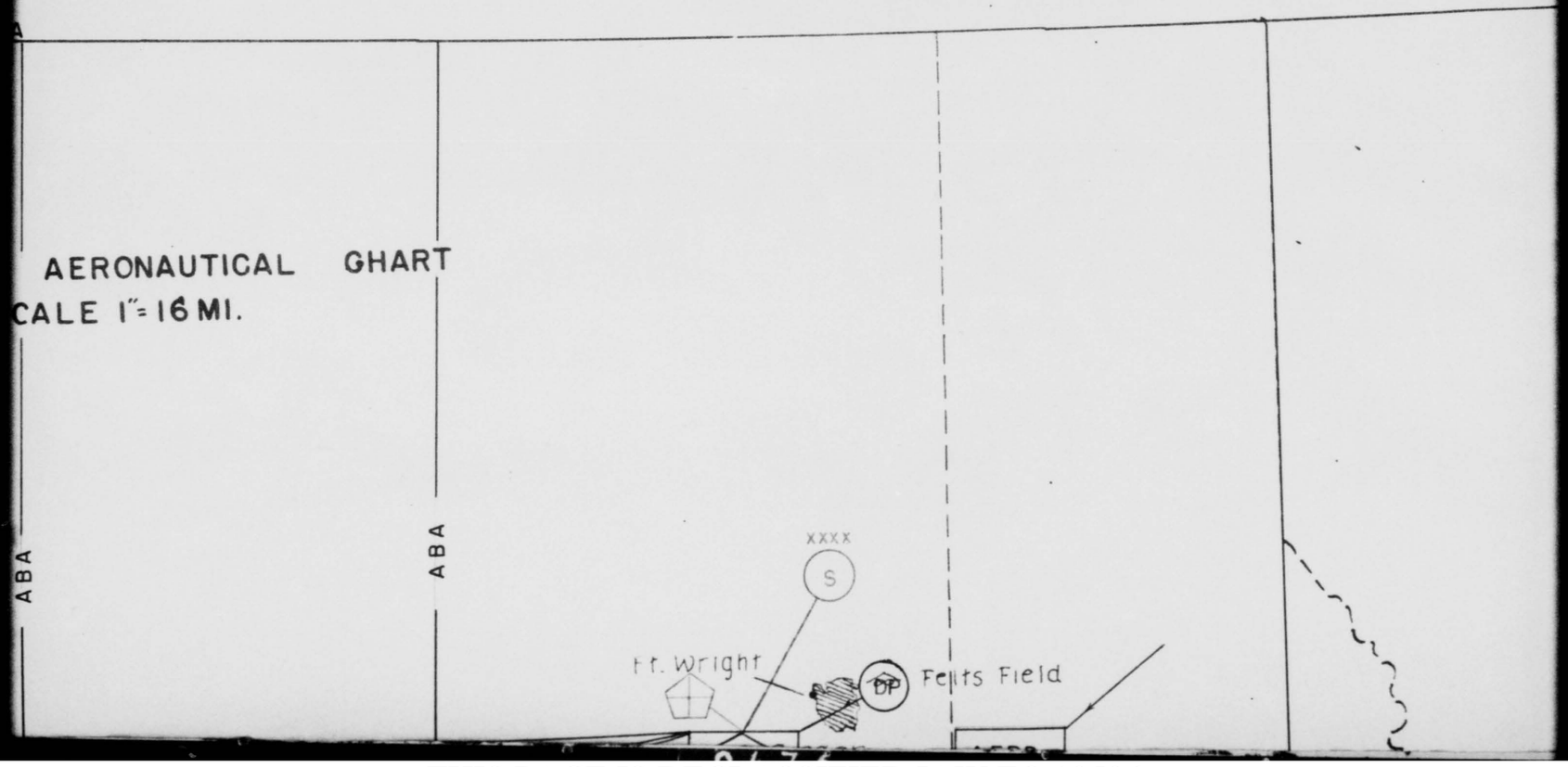

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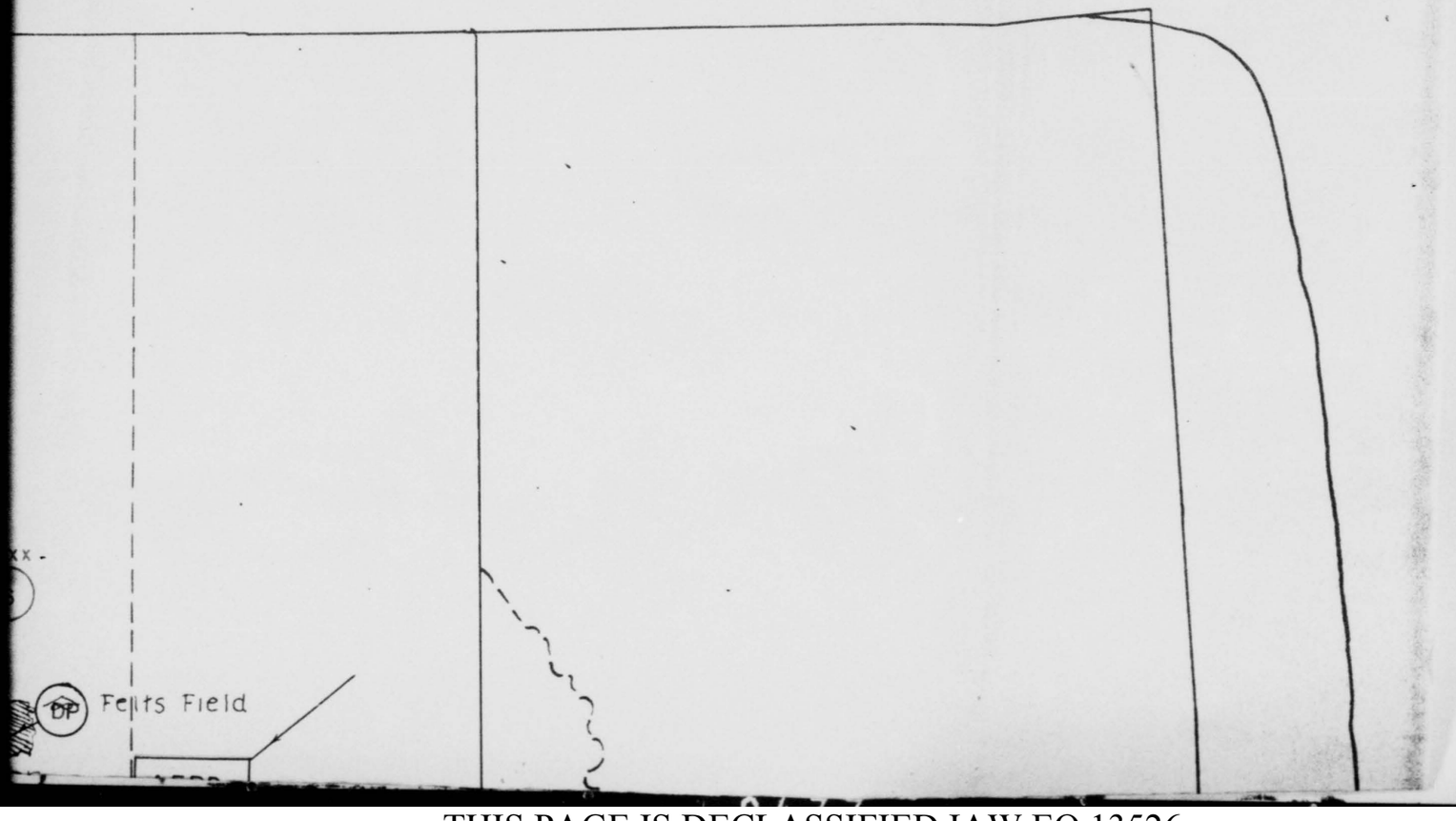

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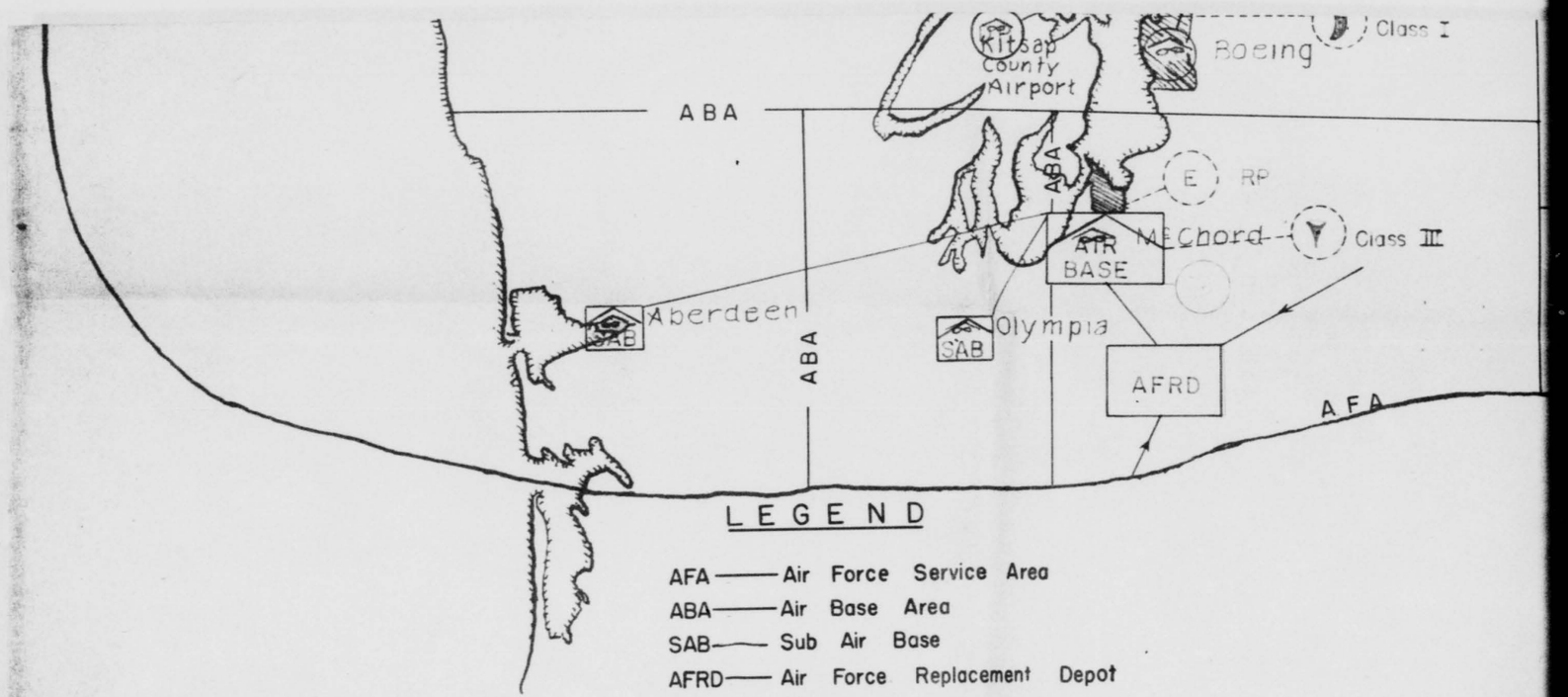

LEGEND

AFA —— Air Force Service Area
ABA —— Air Base Area
SAB —— Sub Air Base
AFRD —— Air Force Replacement Depot
A C —— Blue
Med in Orange
Q M in Brown
Sig in Green
Eng in Red
Chem in Yellow
Ord in Violet

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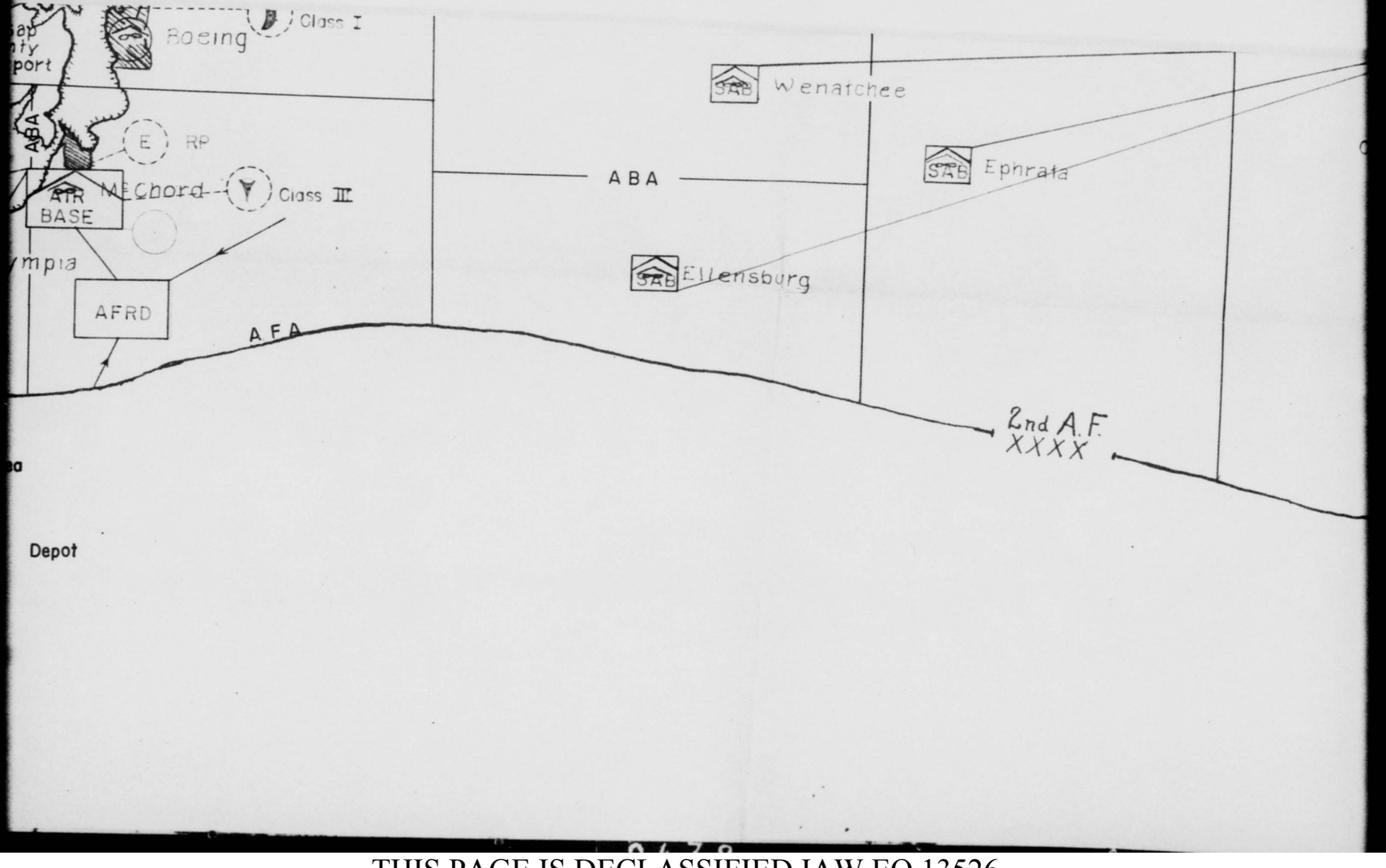

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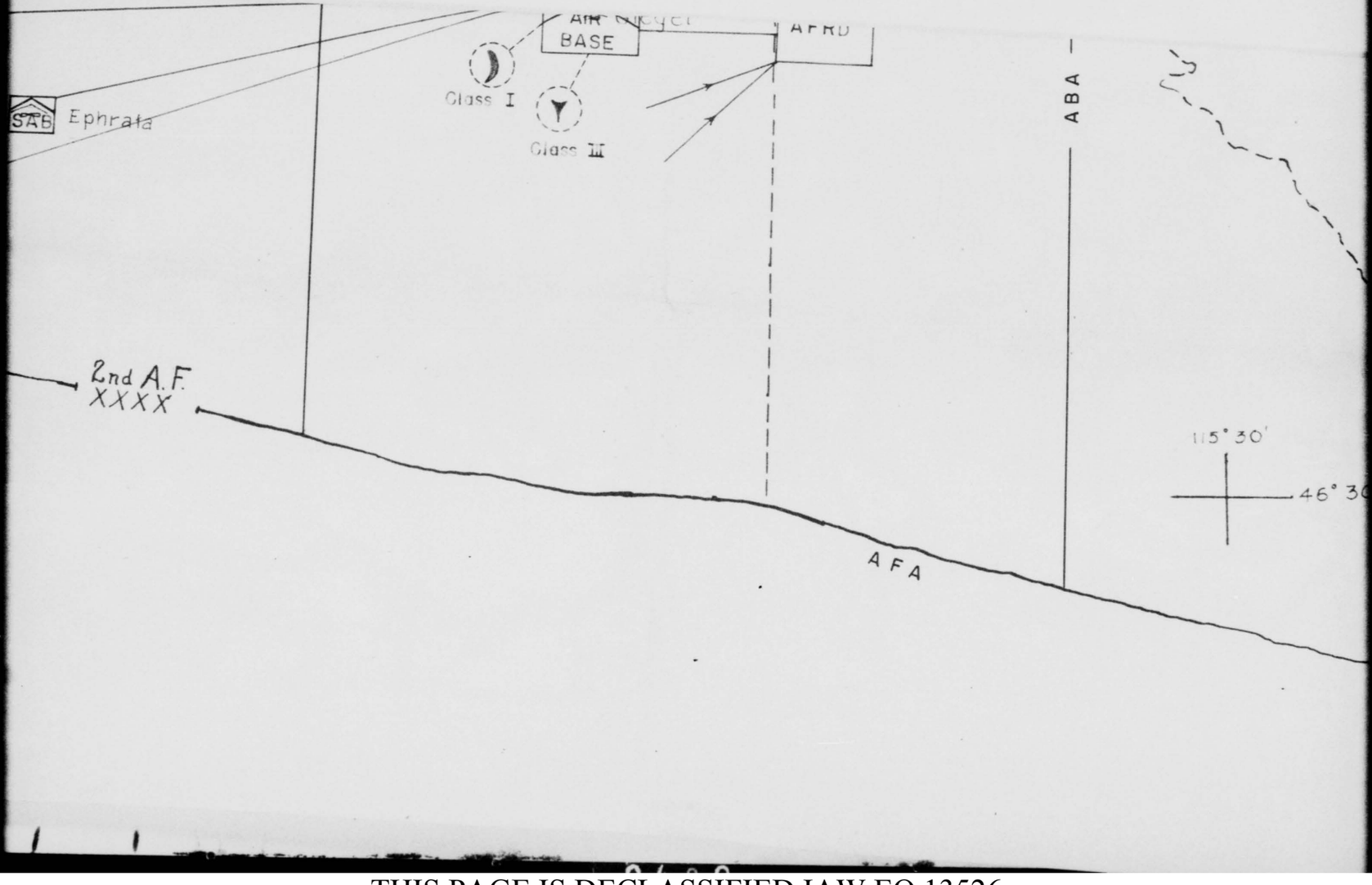

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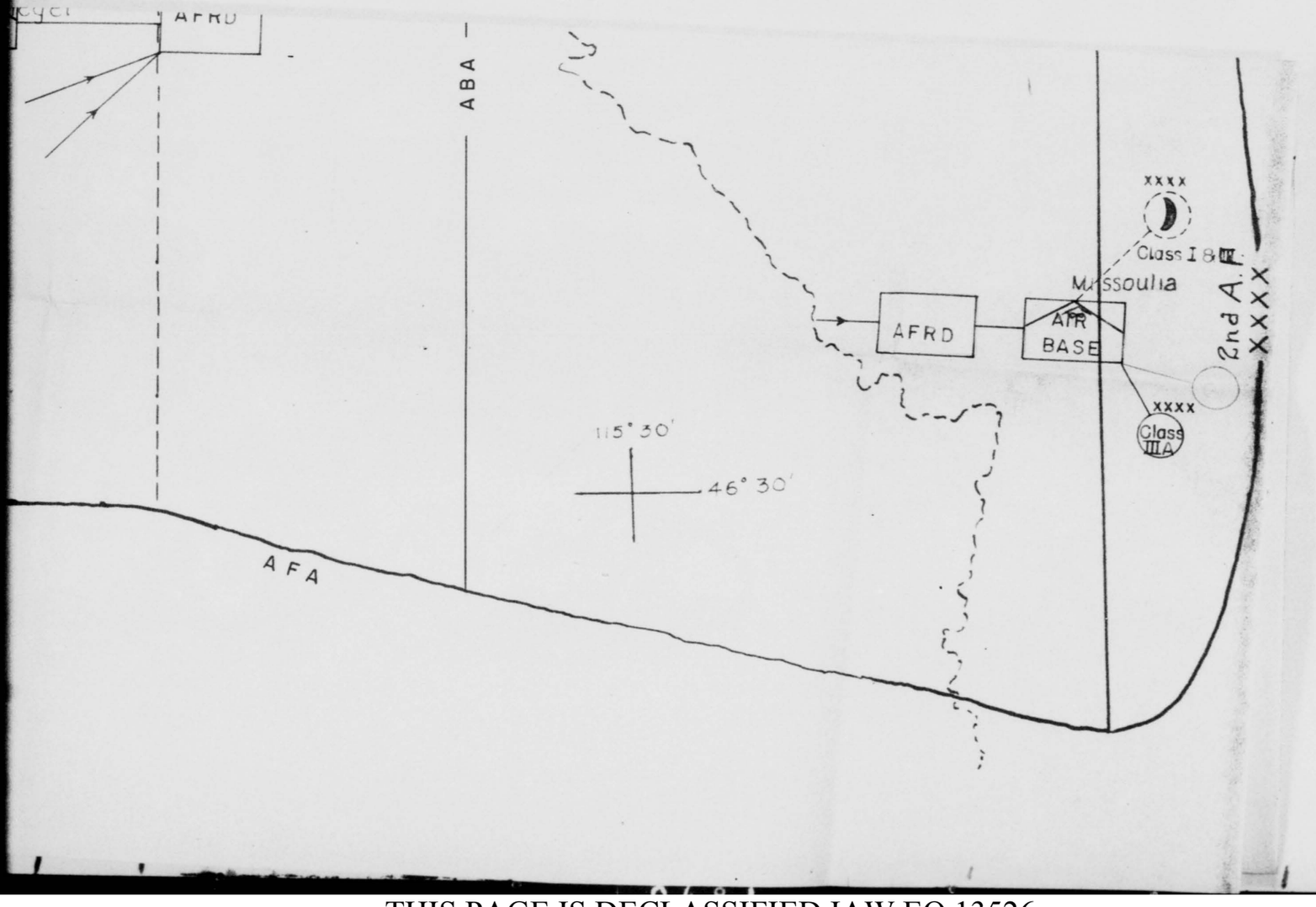

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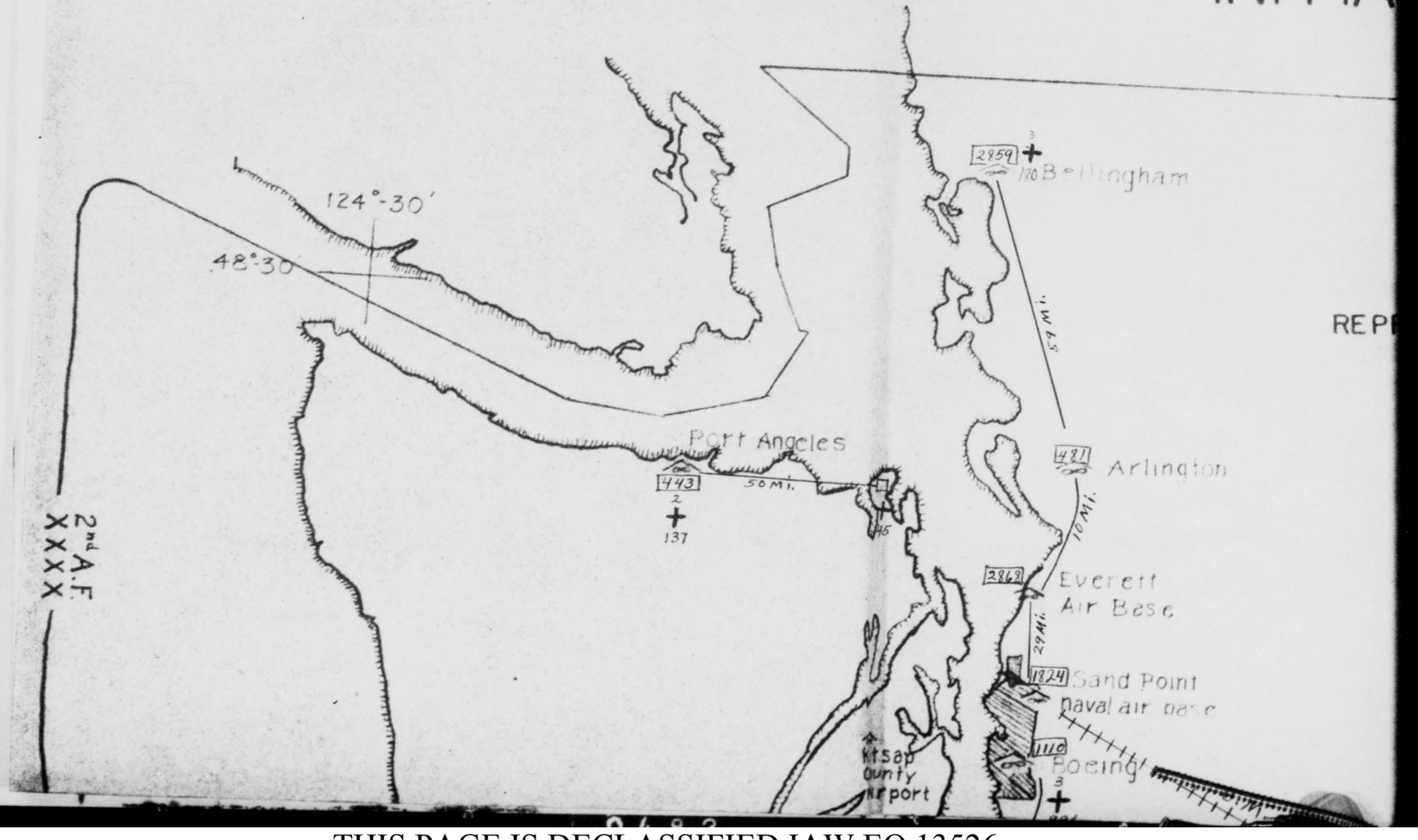

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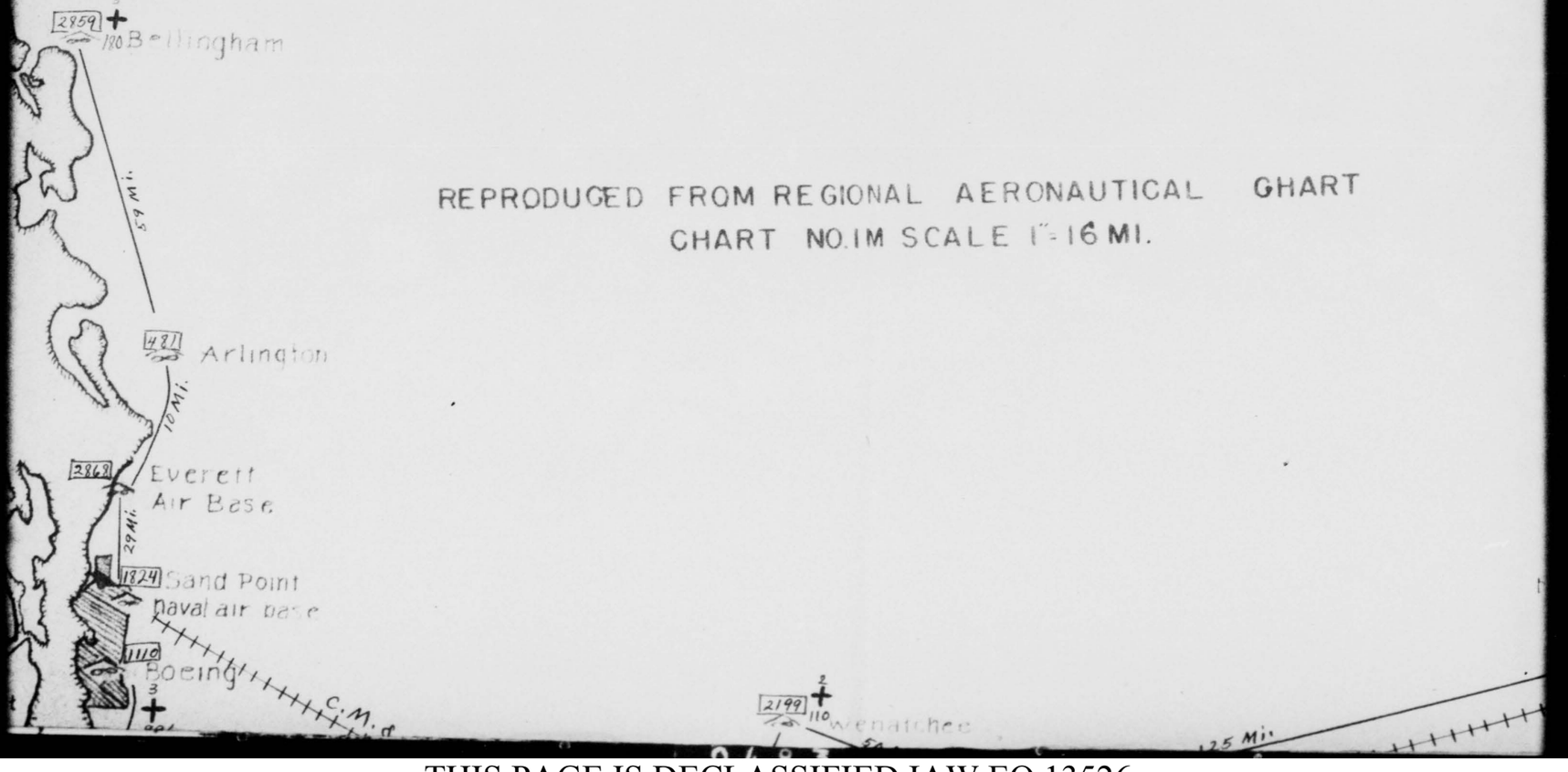

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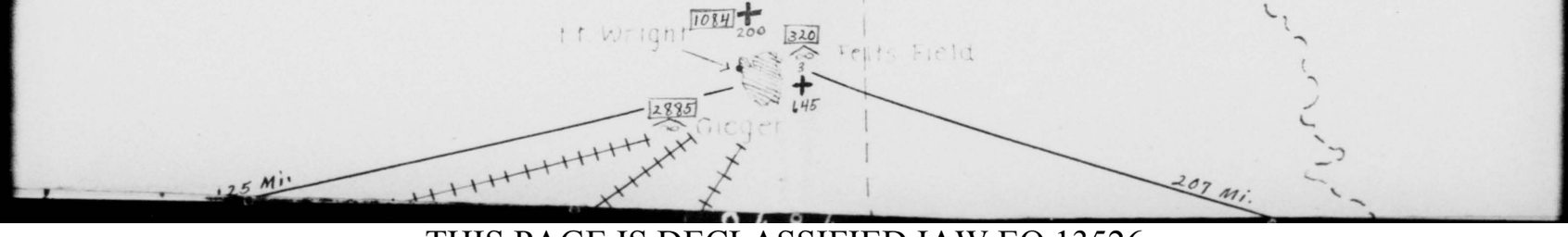

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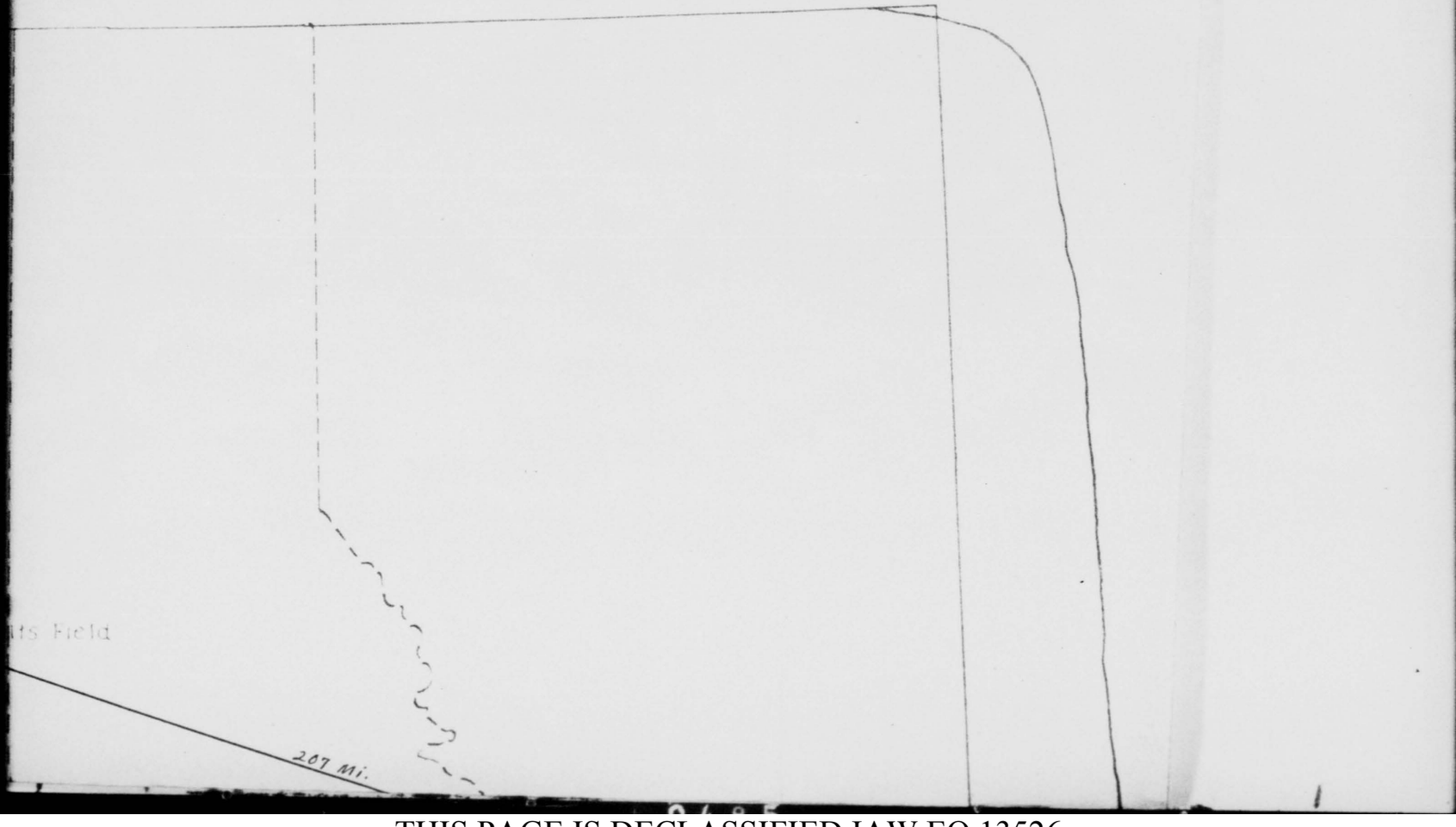

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Red squares indicate troop location – Figures in square : tro

Red crosses indicate Government Hospitals – Red figures

Red crosses within squares indicate Hospital Stations – Fig

Green crosses indicate Civil Hospitals – Figures above cros

of hospitals and figures below : bed capacity

Blue black lines indicate surface roads

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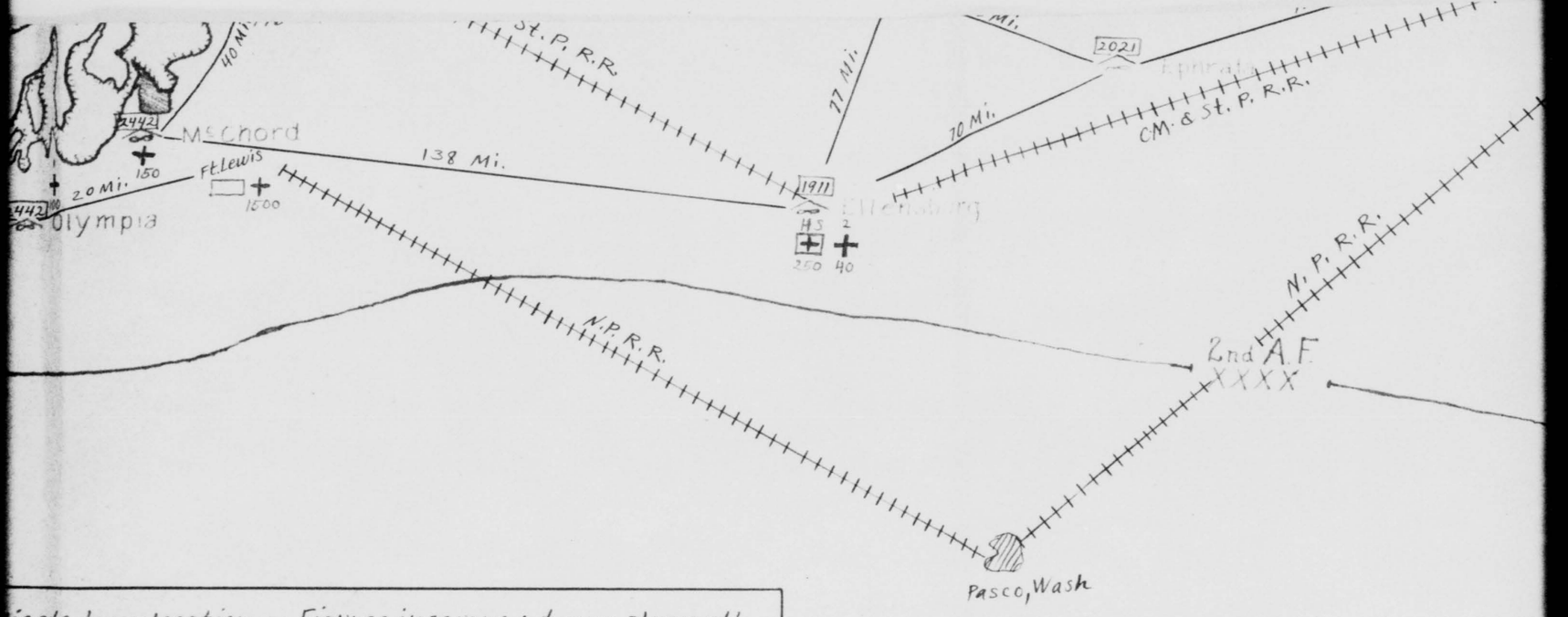

...icate troop location – Figures in square : troop strength
...dicate Government Hospitals – Red figures : bed capacity
...thin squares indicate Hospital Stations – Figures : no. of beds
...indicate Civil Hospitals – Figures above cross is number
...tals and figures below : bed capacity
...ck lines indicate surface roads

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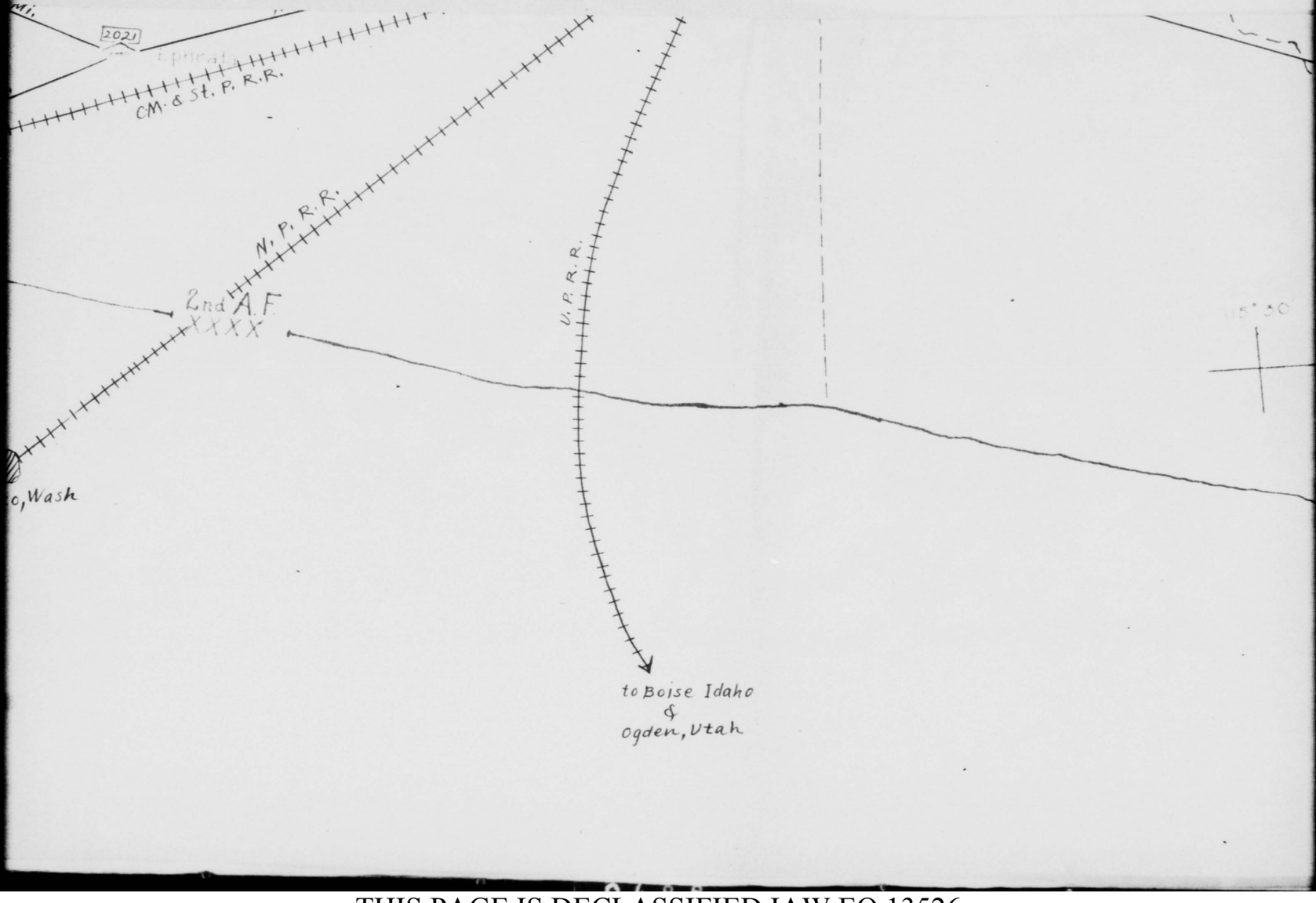

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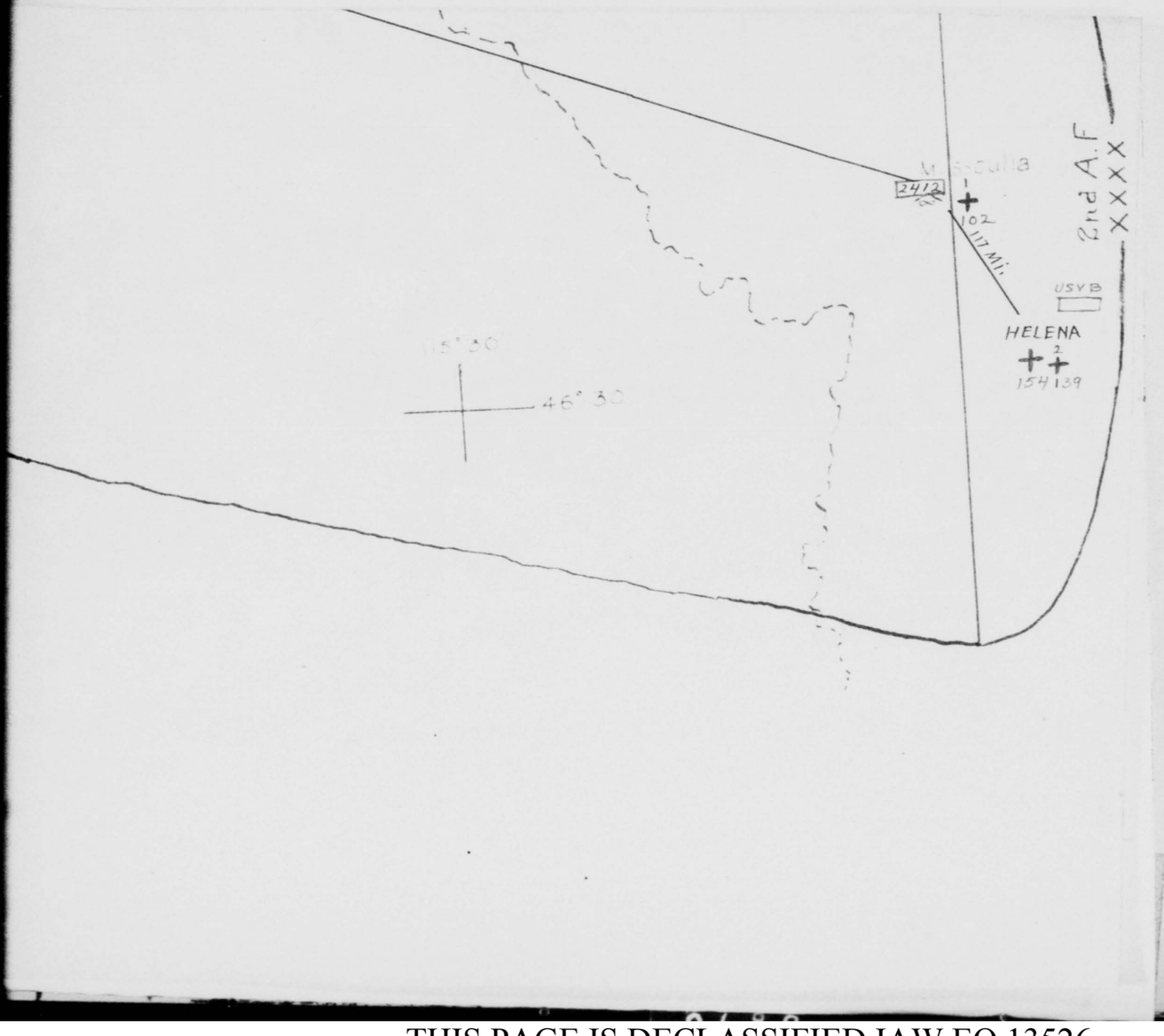

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145.81-145
July-Aug 1971
THE ARCHIVES
THE AAF
HISTORICAL OFFICE

AIRDROME REPORT

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ENGINEER REPORT ON AVAILABLE AIRPORTS

SECOND AIR FORCE AREA

1. Any operation of the Air Force Combat Command in the Northwest depends to a great extent on the number of available airports. There is now in progress an extensive program for development of many civil airports, and the 1942 program will make possible further improvement of these airports as well as initiate the improvement of many other fields. Since the 1942 program has not been definitely decided upon, and as the rate of construction progress under the existing program cannot be depended upon in all cases, it is impossible to state definitely what the condition of each airport will be at a specified time. It may be assumed that airports now being improved could be completed so as to be occupied very soon after a declaration of war. However no other assumptions can be made and in the present problem, plans for the occupation of the Air Force Combat Command are based on occupancy of only those airports which could now be used or which could be improved within a short period of time.

2. The enclosed map indicates in general the airports in the theatre of operations that are available or may be made readily available for occupancy by military aircraft. Those airports shown in blue are either under the 1941 or 1942 improvement program, and when improved, may be used by most types of military aircraft.

3. For those airports indicated in red, there is no existing program for improvement. All of these airports are susceptible of easy development, and their improvement would be one of the first missions assigned to Aviation Engineers.

4. There is also enclosed a table which gives additional information on those airports in Washington, Oregon, Idaho and Utah, which would be used in the contemplated operations. This table shows the condition of the fields which are available or which will be available at the end of the present construction program. In general, this represents the condition which might be expected in the fall of 1941. There is also indicated those airports which will be further improved or upon which improvement will be initiated under the 1942 program. This improvement cannot be expected in all cases to be completed before the summer of 1942. No definite data is now available as to the extent of the improvements to be made under this program.

5. There is also shown on the table a list of airports which may be easily improved and which should be developed in order to provide auxiliary airdromes for dispersion of units of the Air Force Combat Command. This table indicates the estimated time required to place each of these in operating condition by one battalion of Engineer troops.

2 Incls -
Map
Table - Airport Status

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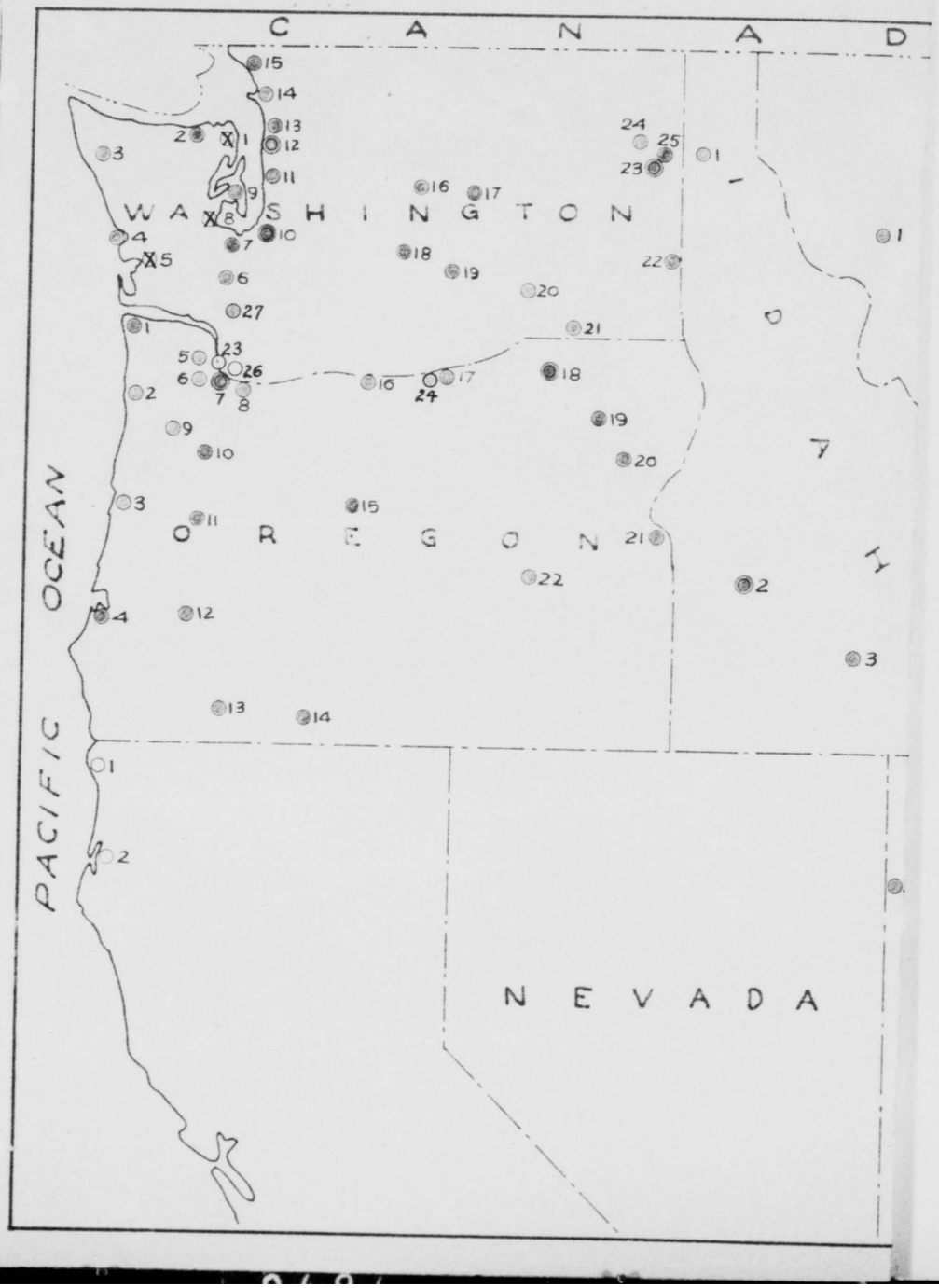

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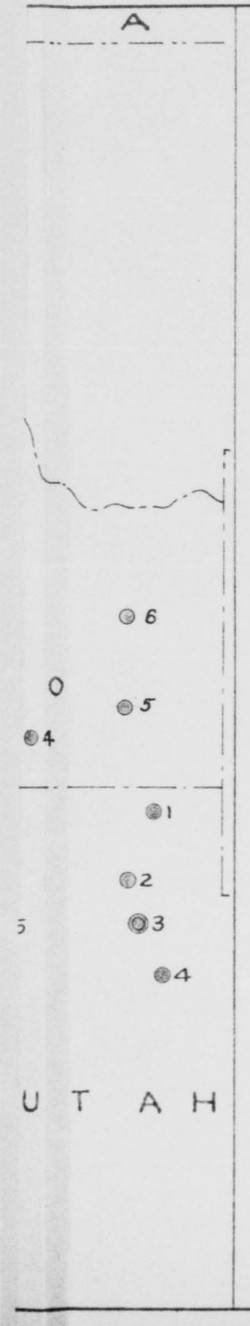

LEGEND

WASHINGTON

1. Port Townsend
2. Port Angeles
3. Forks
4. Aberdeen
5. Willapa
6. Chehalis
7. Olympia
8. Shelton
9. Mitsap Co.
10. McChord Field
11. Seattle
12. Everett
13. Arlington
14. Mt. Vernon
15. Bellingham
16. Wenatchee
17. Ephrata
18. Ellensburg
19. Yakima
20. Pasco
21. Walla Walla
22. Pullman
23. Geiger Field
24. Deer Park
25. Spokane
26. Vancouver
27. Toledo

OREGON

1. Astoria
2. Tillamook
3. Newport
4. North Bend
5. Scappoose
6. Hillsboro
7. Portland
8. Troutdale
9. McMinnville
10. Salem
11. Eugene
12. Roseburg
13. Medford
14. Klamath Falls
15. Redmond
16. The Dalles
17. Boardman
18. Pendleton
19. La Grande
20. Baker
21. Ontario
22. Burns
23. Portland (Swan Island)
24. Arlington

CALIFORNIA

1. Crescent City
2. Eureka

IDAHO

1. Coeur d'Alene
2. Boise
3. Gooding
4. Burley
5. Pocatello
6. Idaho Falls

UTAH

1. Logan
2. Ogden
3. Salt Lake City
4. Provo
5. Wendover

MONTANA

1. Missoula

◉ Airports being improved or to be improved under the 1942* program
◉ Airports not being improved under the 1941* or 1942* program
○ Airports now being used but not satisfactory
*Refers to fiscal year.

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AIRPORT STATUS

	Location	Runways	Surface	Completion date of present project	New 1941-42 Program
WASHINGTON					
2.	Port Angeles	1-5250 ft,	2½" Bituminous	June 30, 1941	No
	" "	1-4770 "	" "	" " "	"
4.	Aberdeen	1-5000 "	" "	Sept. 30, 1941	"
6.	Chehalis	1-2650 "	S 1	Existing	Yes
7.	Olympia	1-3600 "	2½" Bituminous	June 30, 1941	"
		1-4300 "	" "	" " "	"
9.	Kitsap County	1-4000 "	Bituminous	October 1, 1941	"
10.	McChord Field	1-5750 "	3" Bituminous	Existing	"
	" "	1-6000 "	" "	"	"
	" "	1-6350 "	Landing Strip, dirt	"	"
11.	Seattle	1-5950 "	Cement concrete	October 1, 1941	"
12.	Everett	1-5700 "	2½" Bituminous	Existing	"
	"	1-4750 "	" "	June 30, 1941	"
	"	1-4750 "	" "	" " "	"
13.	Arlington	1-4000 "	Dirt	Now being improved by Navy. No data.	
15.	Bellingham	1-5000 "	2½" Bituminous	June 25, 1941	"
	"	1-5000 "	Graded only	July 15, 1941	"
	"	1-4500 "	" "	" " "	"
16.	Wenatchee (Mun.)	1-4500 "	Paved	October 1, 1941	"
	" "	1-4500 "	Graded only	" " "	"
17.	Ephrata	2-3250 "	Landing strip, dirt	Existing	"
18.	Ellensburg	1-3110 "	Landing strip, gravel	"	"
	"	1-3038 "	Landing strip, gravel	"	"
19.	Yakima	2-5000 "	6" Conc. base-1" Bituminous	July , 1941	"
	"	1-4000 "	6" Conc. base-1" Bituminous	" "	"

Note: Numbers on left-hand margin refer to map index.

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AIRPORT STATUS.

	Location	Runways	Surface	Completion date of present project	New 1941-42 Program
WASHINGTON (cont.)					
21.	Walla Walla	1-5000 ft.	Asphaltic Concrete	Aug. 30, 1941	Yes
	" "	1-3500 ft.	" "	" " "	"
22.	Pullman	1-4000 "	2½" Bituminous	Jan. , 1942	"
23.	Geiger Field	1-5760 "	Concrete	Existing	"
	" "	1-5116 "	"	July 31, 1941	"
25.	Spokane (Felts Field)	1-6000 "	Natural Gravel	Existing	"
27.	Sand Point (Naval Air Station				

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AIRPORT STATUS

Location	Runways	Surface	Completion date of present project	New 1941-42 Program
OREGON				
1. Astoria	1-5500 ft.	3" asphaltic concrete	Jan. 1, 1942	
"	1-4000 "	" " "	" " "	
	1-4000 "	" " "	" " "	
4. North Bend	1-3600 "	Landing strip, dirt	Oct. 31, 1941	No
" "	1-3300 "	3" macadam	" " "	"
" "	1-3000 "	Landing strip, dirt	" " "	"
7. Portland	1-4000 "	Asphaltic concrete	Existing	Yes
"	1-4800 "	" "	"	"
"	1-5300 "	" "	"	"
"	1-5300 "	" "	"	"
10. Salem	1-4040 "	2" asphaltic concrete	August 25, 1941	"
11. Eugene	1-4000 "	2" Bit. wearing	Oct. 10, 1941	"
"	1-4000 "	" " "	" " "	"
12. Roseburg	1-3800 "	Oil mat surface	Oct. 31, 1941	No
13. Meford	1-5200 "	2" asphalt	August 15, 1941	Yes
"	1-2300 "	" "	" " "	"
14. Klamath Falls	1-5100 "	2" Bituminous	Oct. 15, 1941	"
" "	1-4600 "	" "	" " "	"
" "	1-3600 "	Landing strip, dirt & sod	" " "	"
15. Redmond	1-4750 "	Bituminous	March 31, 1942	No
"	1-4750 "	"	" " "	"
16. The Dalles	1-4100 "	Graded	August 20, 1941	Yes
" "	1-4100 "	"	" " "	"

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AIRPORT STATUS

	Location	Runways	Surface	Completion date of present project	New 1941-42 Program
OREGON (cont.)					
18.	Pendleton	1-5300 ft.	Bituminous	October 1, 1941	Yes
	"	1-5300 "	"	" " "	"
		1-5300 "	"	" " "	"
19.	La Grande	1-4500 "	2" penetration	Sept. 30, 1941	"
	" "	1-4740 "	Macadam	" " "	"
	" "	1-4568 "	"	" " "	"
20.	Baker	1-5000 "	Black top	August 21, 1941	"
	"	1-4500 "	Landing strip, dirt	" " "	"
	"	1-4130 "	" " "	" " "	"
21.	Ontario	1-4000 "	Gravel - 6"	Existing	"
	"	1-3300 "	" - 3"	"	"

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AIRPORT STATUS

Location	Runways	Surface	Completion date of present project	New 1941-42 Program
IDAHO				
2. Boise	1-8270 ft.	Asphaltic concrete	Existing	No
"	1-6000 "	" "	"	"
"	1-4100 "	" "	"	"
3. Gooding	1-4220 "	Sod	Existing	Yes
"	1-5000 "	"	"	"
4. Burley	1-4260 "	Asphalt paved	July 30, 1941	
"	1-3900 "	" "	" " "	
"	1-4200 "	" "	" " "	
5. Pocatello	1-5600 "	Oiled surfaced	July 1, 1941	Yes
"	1-4300	" "	" " "	"
"	1-4300	" "	" " "	"
6. Idaho Falls	1-5000 "	Black-top	June 30, 1941	"
" "	1-6100 "	" "	" " "	"
" "	1-6700 "	Graded	" " "	"

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AIRPORT STATUS

Location	Runways	Surface	Completion date of present project	New 1941-42 Program
UTAH				
1. Logan	1-4000 ft.	Paved	Sept. 15, 1941	
"	1-4200 "	"	" " "	
"	1-4300 "	"	" " "	
2. Ogden	4-6000 "	Paved	Existing	
3. Salt Lake City	1-4350 "	Paved	Existing	
" " "	2-6000 "	"	"	
5. Wendover	2-7000 "	Paved	Oct. 15, 1941	
MONTANA				
1. Missoula	1-5620 ft.	Graded	Oct. 15, 1941	Yes
"	1-5900 "	Paved	" " "	"
"	1-6400 "	"	" " "	"
"	1-7050 "	"	" " "	"

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AIRPORTS NOT BEING IMPROVED

	Present Status	Time to place in Operation Condition
WASHINGTON		
3. Forks	No field	2 months
14. Mt. Vernon	1 landing strip - 4000 ft.	6 weeks
20. Pasco	1 landing strip - 2[illegible]00 ft.	6 weeks
24. Deer Park	1 landing strip - 4000 ft.	1 month
26. Vancouver	1 landing strip - 3500 ft.	None
27. Toledo	1 landing strip - 4000 ft.	1 month
OREGON		
2. Tillamook	No field	6 weeks
3. Newport	No field	6 weeks
5. Scappoose	No field	6 weeks
6. Hillsboro	2 landing strips - 3000 ft.	1 month
8. Troutdale	1 landing strip - 3200 ft.	1 month
9. McMinnville	No field	6 weeks
17. Boardman*	No field	6 weeks
22. Burns	1 landing strip - 3700 ft. 1 landing strip - 3000 ft.	6 weeks
23. Portland (Swan Island)	1 runway - 3775 ft.	None
24. Arlington	1 landing strip - 4000 ft.	2 weeks
IDAHO		
1. Coeur d'Alene	1 landing strip - 3000 ft.	1 month

*It is expected that this field will be developed this year for use in conjunction with the Arlington Bombing Range.

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HEADQUARTERS ARMY AIR FORCES

ROUTING AND RECORD SHEET

TO THE ARCHIVES OF THE AAF HISTORICAL OFFICE
July-Aug 1941
1945-18-48

(To be filed with correspondence)

Note.—A line will be drawn across sheet after action by each office concerned.

SUBJECT: Concentration Plan of the Air Force Combat Command for the N.W. Area.

NO.	FROM	TO	DATE	DATA
1.	AAF AS	AWPD	1941 8-30	AAF/AS AWV/cmc Attached is "Concentration Plan of the Air Force Combat Command for the Northwest Area". Analyze, coordinating with such other members of the Air Staff as is desirable. 1 Incl:Concentration plan. Chief of Air Staff

Col George
This is to be done as you can work it in. Not high priority
AWV

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AWPD-9/3/4

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July-aug 1941

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Lowry Field, Colorado
August 21, 1941

General George C. Marshall
Chief of Staff, U. S. Army

Dear General Marshall:

In accordance with our conversation yesterday, I am inclosing herewith certain sections of a part of a study that we made for a concentration of the entire Air Force Combat Command in the Second Air Force area which may be of interest to you and give you an idea of some of the problems that confront an Air Force operating in that area. This may be of value to you at this time as you are going into the Northwest area where the problem is laid.

I am giving you only copies of:

Letter of Transmittal,
Concentration Plan,
2nd Air Force Specific Requirements,
Aviation Fuel and Oil Requirements,
Airdrome Report.

We had plans for the 1st, 3rd, and 4th Air Forces similar to that for the 2nd Air Force, but have not inclosed them. We also had a complete Ordnance Plan which is one of the finest efforts that I have ever seen, but it is too much in detail for you. The complete plan is in the office of the Commanding General, Air Force Combat Command.

With less than three weeks to complete this in addition to our other duties, the work entailed was tremendous. We had to make certain assumptions in regard to spares, supplies, etc., that are not accurate at this time, but which should be true in a very few months. So far as I know, this is the first real comprehensive plan of this nature that has been made. Errors have been made due to the tremendous amount of work in the short time available, but the plan is a live one and will, undoubtedly, receive constant revision. All four Air Forces were directed to make plans of this type for their particular areas at this time, so it might be of value to you as you go into any particular Air Force area to get the highlights of the concentration plan for that section.

In order that you may get the highlights and the meat of the problem in each part, I have marked those paragraphs that I think will be of most value and interest to you, and have omitted in this marking a great deal of the detail. However, the headings of most of the paragraphs are such - that you can decide for yourself whether to go into the detail or omit it. I particularly call your attention to the following pages and paragraphs in the concentration plan:

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Page 4, 5, 6, 7, 8, 9, 10, 11; and 12 - par. 3;

Page 14, par. 4; page 18, par. h (Supply Lines);

Page 24, par. e; pages 25, 26, and 27 - par. e (Evacuation);

Pages 29, par. 7a; 32, par. b and c; 33, par. a and b;

38, par. a and b; 39, par. 3 (Security);

39, par. 1a and 1b (Special Comments); Pages 40 and 41.

In the other sections - 2nd Air Force Specific Requirements, Aviation Fuel and Oil Requirements, Airdrome Report - I have just marked certain paragraphs that might be of interest.

This outlined summary for the four parts inclosed should take you less than an hour to read. When you are through with the plan, will you please return it to me as these are the only copies I have.

I enjoyed very much our brief meeting, and hope that you will make Denver your stopover on your trips across the country.

With best regards,

Sincerely,

John F. Curry

JOHN F. CURRY
Major General, U. S. Army

5 Incls.
Ltr. of Transmittal
Concentration Plan
2nd A.F. Specific Require.
Aviation Fuel and Oil Require.
Airdrome Report

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Page 24, par. c; pages 25, 26, and 27 - par. e (Evacuation);

Pages 29, par. 7a; 32, par. b and c; 33, par. a and b;

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With best regards,

Sincerely,

JOHN F. CURRY
Major General, U. S. Army

5 Incls.
Ltr. of Transmittal
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Aviation Fuel and Oil Require.
Airdrome Report

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COPY

HEADQUARTERS SECOND AIR FORCE
Office of the Commanding General
Fort George Wright, Washington

AF 063.01 (7-2-41) July 30, 1941

Subject: Logistical and Communications Plan for the Concentration Air Force Combat Command, Second Air Force Area.

To: Commanding General, Air Force Combat Command, Bolling Field, D. C.

1. Pursuant to instructions contained in letter your headquarters, file AF 061.01, dated July 2, 1941, transmitted herewith are four copies of the Logistical and Communications Plan for the concentration of the entire Air Force Combat Command in the Second Air Force area. Since the concentration is based on the most probable employment of the Combat Command in the Second Air Force area, it is impossible to divorce logistical and communications planning from the tactical and operational phase. Accordingly, the Logistical and Communications Plan is incorporated in a war plan.

2. The Pacific Telephone and Telegraph Company is at present making an extensive survey of the telephone and telegraph facilities in the Second Air Force area in order to arrive at the cost and time requirements incident to supplying communications facilities as outlined in the Communication Plan.

3. Both the Bomber Command and the Bombardment Wings are provided for in the Communications Plan. If the Bombardment Wings are eliminated, as at present contemplated, wing terminals in the wire net can be by-passed; likewise, the radio net can be altered with no difficulty.

4. This plan has been coordinated with the Western Defense Command and the Fourth Air Force.

JOHN F. CURRY
Major General, U. S. Army

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145. 51 - 15
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APPRECIATION OF TACTICAL UTILITY OF HABBAKUK

Report by the Joint Staff Planners

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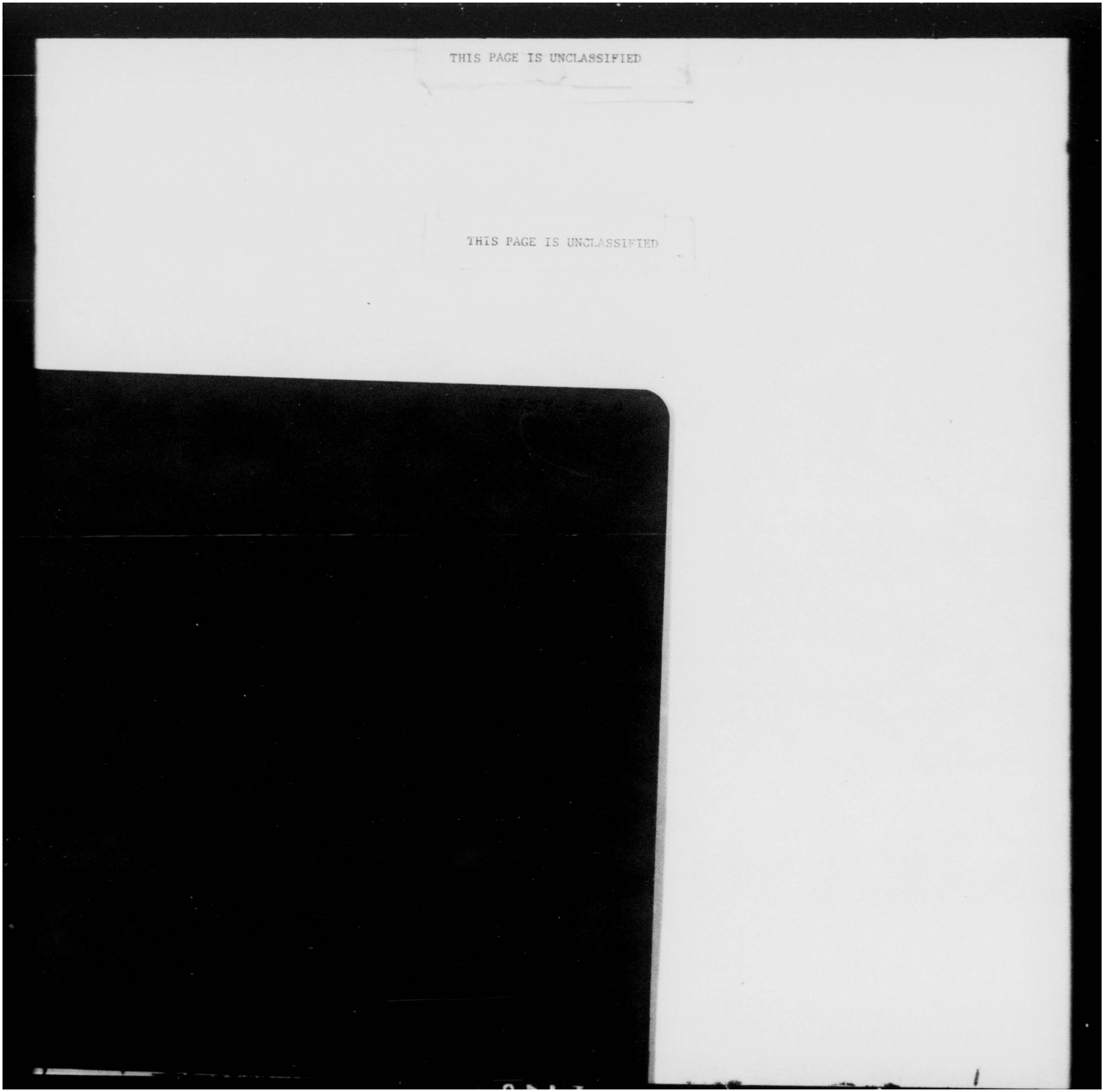

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8 July 1943
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APPRECIATION OF TACTICAL UTILITY OF HABBAKUK

PART I - HABBAKUK I

References: a. C.C.S. 288; C.C.S. 288/1
b. HABBAKUK II, Combined Operations Headquarters, London, 8 July 1943

REPORT BY THE JOINT PLANNING STAFF

THE PROBLEM

1. Prepare and submit, as a matter of urgency an appreciation of the tactical utility of the project HABBAKUK I, together with conclusions and recommendations of the feasibility of employing this project in connection with planned operations.

FACTS BEARING ON THE PROBLEM

2. HABBAKUK I is a floating airdrome, made principally of timber, which does not include means for self-propulsion.

3. See APPENDIX "A" for evaluation of tactical utility of HABBAKUK I.

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CONCLUSIONS

4. The proposed vessel will support the continuous operation of 150 to 200 fighter aircraft at a rate of 40 to 80 seconds per aircraft. Its aircraft capacity is the equivalent of 5 to 7 escort carriers and its aircraft servicing rate is equivalent to that of 2 to 3 escort carriers. It possesses no power of defense except that provided by its own fighter cover and is very susceptible to damage by gasoline fire and bombing.

5. The immobility of this vessel and the limitation of aircraft types imposed precludes its offensive use except in special amphibious operations which can be accurately timed and planned well in advance.

RECOMMENDATIONS

6. That construction of HABBAKUK I be undertaken only if required for a specific operation.

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APPRECIATION OF TACTICAL UTILITY OF HABBAKUK

PART II - HABBAKUK II

References: a. C.C.S. 288; C.C.S. 288/1
b. HABBAKUK II, Combined Operations Headquarters, London, 8 July '43.

REPORT BY THE JOINT STAFF PLANNERS

THE PROBLEM

1. Prepare and submit, as a matter of urgency, an appreciation of the tactical utility of the project HABBAKUK II, together with conclusions and recommendations of the feasibility of employing this project in connection with planned operations.

FACTS BEARING ON THE PROBLEM

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2. HABBAKUK II is a floating, self-propelled airdrome made principally of Pykrete, a material composed of 86% ice and 14% wood pulp, using natural cold weather for initial freezing and artificial refrigeration to maintain a solid structure thereafter.

3. See APPENDIX "B" for evaluation of tactical utility of HABBAKUK II.

CONCLUSIONS

4. Due to the time required for development and construction, HABBAKUK II is destined for 1945 operations against Japan.

5. The probable strategic situation and availability of aircraft carriers and long-range bombers will operate to limit the utility of HABBAKUK II, chiefly to employment as staging points on the ocean airways in connection with air ferrying operations.

6. Its use for other purposes is tactically feasible, but would overlap functions that could be performed as well, if not better, by aircraft carriers and long-range bombers operating from continental and insular bases.

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7. The value of HABBAKUK II in any tactical role will depend upon its capacity to absorb punishment, and the efficiency of damage control procedures. These in turn, depend upon the properties of Pykrete. Full scale tests of the ability of Pykrete to resist damage by bombs and projectiles have not been made.

8. The deck is too short for the practical operation of U.S. Army aircraft considering average pilot skill. Arrester gear cannot be "fitted" to Army aircraft.

9. When examined in the light of the probable strategic situation in 1945, and considering the planned availability of 115 U.S. and British aircraft carriers at that time, this project appears less attractive than initial studies might have indicated.

RECOMMENDATIONS

10. That extensive ordnance tests be initiated to determine the effect

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or bombs and projectiles on representative sections of Pykrete, 40 feet in thickness.

11. That no practical commitments be made in regard to this project until these tests have been completed.

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APPRECIATION OF THE TACTICAL UTILITY OF HABBAKUK

PART III - HABBAKUK III

Reference: a. C.C.S. 288; C.C.S. 288/1.

REPORT BY THE JOINT PLANNING STAFF

THE PROBLEM

1. To prepare and submit, as a matter of urgency, an appreciation of the tactical utility of the project HABBAKUK III, together with conclusions and recommendations of the feasibility of employing this project in connection with planned operations.

FACTS BEARING ON THE PROBLEM

2. In a recent British proposal (See APPENDIX "C") a small, steel version of HABBAKUK II was suggested; this model was called HABBAKUK III.

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It was suggested that HABBAKUK III be made of steel, with a length of 1000/1200 feet, speed about 12 knots, sufficient beam to operate fighters and naval aircraft, and light, twin-engine bombers, and provided with protected stowage for aircraft.

3. It is contended that a small fleet of HABBAKUK III's is preferable to a large fleet of escort carriers because:

a. For a given number of operational aircraft HABBAKUK III requires:

(1) less steel, and steel of a type easier to obtain.

(2) less horsepower, and certain of the engines would be of a type more easy to obtain.

(3) less labor, and labor of a type which will shortly be freed from other war constructional projects.

b. Coordination and forming-up of aircraft flying from a smaller number of vessels would be simplified.

c. Sea-room for handling the vessels would be greatly reduced, and thus concentration, control and mutual support gained.

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d. The extreme vulnerability of our escort carriers is bound to be bad for morale, while operating against shore based aircraft, and this counterbalances to a large extent the advantage they gain from the "eggs" being distributed among a very large number of "baskets".

4. In contrast to these claims it should be noted that:

a. HABBAKUK III is limited in its operational uses because of its slow speed (12 knots). Thus, while a carrier could perform all missions that can be performed by HABBAKUK III, the latter is not suitable for all carrier missions.

b. HABBAKUK III would have approximately eight times the deck area of an escort carrier and only sixty percent of its speed; consequently, it would present a "sitting-duck" target to a determined bombing attack.

c. Being a new vessel of an entirely new class, the construction of HABBAKUK III would present many technical problems and require extensive operational trials before an effective fighting weapon re-

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sulted. This must be considered in connection with the fact that the aircraft carrier is a "fait accompli" whose production is already proceeding on an efficient, highly organized basis.

5. The deck is too short for landplane operations without arresting gear and assisted takeoff gear.

RECOMMENDATIONS

6. It is recommended that the construction of HABBAKUK III be eliminated from further consideration as a weapon for use by the United States.

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APPENDIX "A"

APPENDIX "A"

APPRECIATION OF TACTICAL UTILITY OF HABBAKUK I

I. The Problem

1. To prepare and submit, as a matter of urgency, an appreciation of the tactical utility of the project HABBAKUK I, together with conclusions and recommendations of the feasibility of employing this project in connection with planned operations.

II. Discussion

2. Assumptions. In examining the uses of this weapon, it has been assumed that:

a. All technical problems of design, construction, production and delivery to theater of employment have been solved.

b. The required number of units can be delivered by the Spring of 1944.

c. Successful operational development can be completed in time for its use in planned operations.

d. Arresting gear will be installed.

e. Means will be provided to maintain its desired position and a direction approximately into the wind.

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f. Servicing and rearming facilities will be incorporated in the structure.

g. Construction does not in any way interfere with the allocation of critical materials or equipment to other war production; in particular, aircraft carrier production.

h. Requirements of labor do not conflict unduly with the allocation of manpower to the services and to war industry.

3. General Description. This project contemplates the construction of a number of all-wood floating airdromes of dimensions approximately 1500 feet x 250 feet which would be towed to the action station and maintained in position by means of tugs. See ANNEX "A" for summary of characteristics.

4. Criteria Governing Evaluation. The vessel is in effect a floating airdrome whose usefulness will be largely determined by:

a. The planned operation(s) for which it is intended.

b. Number and types of aircraft that can be supported, and their characteristics.

c. The speed with which aircraft can be recovered, serviced, rearmed, and launched.

d. Ease of repair to flight deck.

e. Effectiveness of fire fighting provisions for flight deck.

f. Effectiveness of defense provided by screening units.

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5. a. General Characteristics of HABBAKUK I vs Escort Carriers. This immobile, floating airdrome would be entirely dependent for protection upon the aircraft operating therefrom and such surface screen provided. No provision for anti-aircraft artillery has been considered. Its all-wood structure would be very vulnerable to damage particularly with regard to flight deck fires. Its chief advantage lies in the capacity to support operation of large numbers of naval fighter type aircraft.

b. The CVE (Kaiser) class carrier is at least equally vulnerable to damage by bombs, gun fire or torpedo fire but possesses a reasonable measure of defense in its manouverability and anti-aircraft battery. Its mobility allows considerable flexibility of employment. Its capacity to operate aircraft is very limited in comparison with HABBAKUK I.

6. a. Availability of HABBAKUK I vs Escort Carriers in 1944. No estimate has been made of the number of HABBAKUK I's which can be made available by Spring 1944 although it has been stated that at least one can be constructed and delivered by that time if high precedence is assigned this project.

b. According to present plans of the British Navy 34 escort carriers will have been placed in operational status by 30 June 1944. Estimated losses and other factors will reduce the number available to 16. The U.S. Navy plans to place 48 escort carriers in commission by that date. If the same ratio is applied to the latter figure, the total number of escort carriers which may be considered available on 30 June 1944 will be 39.

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a. Functions of HABBAKUK I vs Planned Operations. Owing to the length of time and effort required to place this airdrome in its action station, its use will be limited to those operations which are accurately timed and suitable for long range planning. Owing to its vulnerability it can only be employed in offensive operations where its mission will be completed in one or at most two daylight periods.

b. These considerations and the fact that only naval carrier type aircraft can be operated limit its employment to support of a close-coupled amphibious operation. An amphibious attack, across the English Channel against France or the low countries is the only conceivable operation in prospect which could profitably employ HABBAKUK I, since in these operations, a fighter screen operating from England could cover the movement of HABBAKUK I to its action station.

C. Practical Operations from HABBAKUK I.

a. All U.S. Naval fighter types of aircraft which will be available in 1944 can be operated from HABBAKUK I without assistance of wind, jet, or catapult. The prospective availability of jet assisted takeoff will extend operation to include most of the important U.S. Naval carrier types. F4U (Corsair) and F6F(Hellcat) fighter aircraft will be available and most suitable for fighter support in amphibious operations, hence estimates of capacity have been based on dimensions of these folding wing aircraft. The 1500' x 250' deck area, when divided into landing, parking, and takeoff space, as shown in ANNEXES "B" and "C", can support operations of between 150 and 250 aircraft. The lower complement gives maximum flexibility in overcoming flight deck damage as well as maximum rate of operation. The higher complement makes maximum use of the deck area but at the expense of flexibility and speed of operation. ANNEX "D" shows by comparison that the maximum capacity for the initial launching from an escort carrier is 40 planes and for continuous operation is reduced to 30.

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b. No Army fighter type aircraft can be operated from HABBAKUK I.

c. During the short useful life of this weapon continuous and intense air action can be expected. Hence, speed of operating aircraft is at least as important as total capacity. Speed in servicing and rearming and flexibility in shifting functions of landing, servicing and launching between the various areas require adequate fuel and ammunition supply to many points on the deck. The higher aircraft complements also require some increase in facilities. It is probable that, to avoid excessive expenditure of material and effort, the complement or operating capacity should not be over 150 aircraft. Continuous operation at the rate of 40 seconds per aircraft should be realized under these conditions; the corresponding rate of operating 30 aircraft from an escort carrier is 90 seconds per aircraft.

d. The vulnerability of this weapon and the necessity for supporting intensive operations makes it mandatory to provide at least two HABBAKUK I's operating together. Four within mutual supporting distance is preferred.

3. Capacity of HABBAKUK I to Withstand Damage.

a. The flight deck will be most vulnerable to gasoline fire and protection against this damage is essential. Damage by bomb hits should be susceptible to temporary repair.

b. The effect of torpedo hits has not been stated but it probably would be considerably less damaging than to an escort carrier.

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10. The operation of aircraft from a deck such as this does not present any important new problems except the operation of two arresting gears and the handling of a near-capacity aircraft complement. These problems as well as that of manouvering the tugs to maintain direction into the wind would require a development period to work out. This period should not be as extensive as for other HABBAKUK proposals.

III. Conclusions

11. The proposed vessel will support the continuous operation of 150 to 250 fighter aircraft at a rate of 40 to 80 seconds per aircraft. Its aircraft capacity is the equivalent of 5 to 7 escort carriers and its aircraft servicing rate is equivalent to that of 2 to 3 escort carriers. It possesses no inherent power of defense and is very susceptible to damage by gasoline fire and bombing.

12. The immobility of this vessel and the limitation of aircraft types imposed precludes its offensive use except in special amphibious operations which can be accurately timed and planned well in advance.

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ANNEX "A" TO APPENDIX "A"

A

Length	1500 feet
Beam	250 feet
Draft	45)
Freeboard	35) overall depth 80 feet
Propulsion	No provisions
Towing speed	2 knots (estimated)
Displacement	Unknown
Hangar space	None
Equipment and Facilities that should be provided:	
Arresting gear	2 complete sets
Fueling of aircraft	Sufficient to maintain maximum rate of handling aircraft on the deck. Capacity for at least 12 hours operation at this maximum.
Rearming of aircraft	Sufficient to maintain maximum rate of handling aircraft on the deck. Capa-

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	city for at least 12 hours operation at this maximum.
Fire fighting	Adequate to control gasoline and aircraft fires on flight deck only.
Damage control	Temporary repairs to flight deck only.
Naval Aircraft	All naval fighter type aircraft for carrier service under procurement or contemplated can be operated. Other carrier type naval aircraft can be operated if moderate load restrictions are accepted in several cases. Capacity for current naval fighter types 150 to 250 depending on degree of flexibility of operations desired.

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ANNEX "B" TO APPENDIX "A"

PLAN FOR OPERATING 150 FIGHTER AIRCRAFT FROM KAMRAKUK I

B

1. This arrangement would employ two arresting gears abreast located at the stern of the deck and occupying one third of the total area. Of the remaining area a strip 1000' x 100' would be used for parking, servicing and rearming aircraft. The remaining strip 1000' x 150' would serve as a takeoff and taxi area.

2. Employment of both arresting gears would allow an average landing interval of 40 seconds between aircraft.

3. A safe takeoff interval is considered to be 30 seconds between aircraft.

4. The servicing and rearming facilities can be arranged to provide a continuous flow of aircraft to the takeoff position. Hence the 40 second landing interval would be the governing factor in speed of operations.

5. Launching time required for group of 150 aircraft - 1 hour 15 minutes.
Landing time required for group of 150 aircraft -

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6. Flexibility is obtained by shifting parking and takeoff areas. Two arresting gears provide a safety factor.

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ANNEX "C" TO APPENDIX "A"

PLAN FOR OPERATING 250 FIGHTER AIRCRAFT FROM HANDAKUK I

C

1. This arrangement provides for operating only one arresting gear. However, two arresting gears would be installed abreast at the stern of the deck and occupy one-third of the total area. Of the remaining area, a strip 1000' x 100' would be used for parking, servicing and rearming 165 aircraft. An additional 85 aircraft could be handled in the area of the unused arresting gear. The remaining strip 1000' x 150' would serve as a takeoff and taxi area.

2. Estimated landing interval - 60 seconds between aircraft.

3. A safe takeoff interval is considered to be 30 seconds between aircraft.

4. The servicing and rearming facilities can be arranged to provide a continuous flow of aircraft to the takeoff position. Hence, the 60 second landing interval would be the governing factor in speed of operations.

5. Launching time required for a group of 250 aircraft - 2 hours 5 minutes.
Landing time required for a group of 250 aircraft - 5 hours 33 minutes.

6. Flexibility is obtained by shifting parking and takeoff areas. The second arresting gear provides flexibility and a safety factor.

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ANNEX "D" TO APPENDIX "A"

OPERATING CAPACITY OF CVE (KAISER) CLASS CARRIER

FOR COMPARISON WITH HARBOUR I

1. Dimensions of carrier deck area - 470 feet x 80 feet (plus hangar deck).

2. Maximum operating capacity - 30 F4U (Corsair) or F6F (Hellcat) An initial complement of 40 can be accepted for initial launching. Recovery, however, is limited to 30 aircraft.

3. Aircraft launching and recovery must be separate operations unless catapult is employed.

4. Average landing interval - 1 minute.

5. Average takeoff interval - 30 seconds.

6. Average catapult interval - 1 minute 20 seconds.

7. If catapult is not used the cycle of recovering, servicing, rearming and launching 30 aircraft would require 1 hour or 2 minutes per aircraft.

8. By use of catapult aircraft can be recovered, serviced, rearmed and launched at an average interval of 1 minute and 20 seconds.

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COMPARISON OF CVE AND HABBAKUK I OPERATING CAPACITIES

	CVE	Habbakuk I
Maximum Flexibility		
Capacity	30	150
Average interval per aircraft (Fly off - cyclic operation)	120 seconds	40 seconds
(Catapult - continuous operation)	80 seconds	
Maximum Capacity		
Capacity	30	250
Initial launch only	(40)	
Average interval per aircraft (Fly off - cyclic operation)	120 seconds	80 seconds
(Catapult - continuous operation)	80 seconds	

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APPENDIX "B"

APPRECIATION OF TACTICAL UTILITY OF HABBAKUK II

I. THE PROBLEM

1. To prepare and submit as a matter of urgency, an appreciation of the tactical utility of the project HABBAKUK II, together with conclusions and recommendations of the feasibility of employing this project in connection with planned operations.

II. DISCUSSION.

2. Assumptions.- In examining the uses of this weapon it has been assumed that:

a. "Trident" operations will be successful and the United Nations will, by mid-1945, control the Gilberts, Marshalls, a portion of the Carolines, the Solomons, New Guinea, and Wake.

b. All constructional problems have been solved.

c. Vessel will be fitted with arrester gear and provided with ramps or elevators leading from flight deck to a hangar deck.

d. Operational trials have proved satisfactory.

e. Construction does not in any way interfere with the allocation of critical materials or equipment to other war production; in particular, aircraft carrier production.

f. Requirements of labor do not conflict unduly with the allocation of manpower to the Services or to war industry.

3. General Description.- This project contemplates the construction of six to eight vessels made principally of Pykrete, a material composed of 86% ice and 14% wood pulp, using natural cold weather for initial freezing and artificial refrigeration to maintain a solid structure thereafter. The Pykrete hull is protected from wave action and insulated by timber sheathing, applied over a layer of suitable insulating material. A summary of the principal characteristics of HABBAKUK II is attached as ANNEX "A".

4. Criteria Governing Evaluation.- The vessel is in effect a floating airdrome whose usefulness will be largely determined by:

a. Its resistance to damage, and ease with which repairs can be effected without interference with performance of its normal mission.

b. Number and types of aircraft that can be supported, and their characteristics.

c. The general strategic situation in 1945.

d. Planned or probable operations against Japan in mid-1945.

e. Comparison with, and availability of, aircraft carriers which will be in commission during the Summer of 1945.

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APPENDIX "B"

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f. Ferrying requirements for aircraft, and the availability in 1945 of island and continental bases located along Pacific ferrying routes.

5. a. General Characteristics of HABBAKUK II vs Carriers.- A modern carrier possesses a long radius of action at 30 knots sustained speed, is completely equipped to maintain and operate its complement of aircraft, and is defended by director controlled AA artillery. Its mobility contributes materially to its defense, and also enables it to achieve surprise and concentration of large air units.

b. HABBAKUK II is provided with motive power only for the purpose of moving to its combat station, and there to hold it headed into the wind. No mention could be found in the basic paper regarding AA defenses, although it is believed that adequate defenses could be mounted. It appears that the principal defense of this vessel will be derived from its aircraft complement, and its capacity to absorb punishment.

6. a. Availability of HABBAKUK II vs Carriers in 1945.- According to a British construction schedule it will require about one year to construct HABBAKUK II. The vessel must be constructed in a climate where a long period of freezing weather will be assured. British estimates indicate that a fleet of six and possibly eight of these vessels could be constructed by the Spring of 1945. This being the case, it is apparent that the weapon is destined for employment in the war against Japan.

b. According to present plans of the U. S. Navy, it is expected that there will be in commission by June 1945, 72 aircraft carriers of all classes. The building program contemplated by the British, both here and abroad, will provide 43 more carriers by the above date. Thus, by mid-1945 the United Nations expect to possess a force totalling 115 aircraft carriers.

7. a. Functions of HABBAKUK II vs 1945 Operations.- While no approved plan exists governing 1945 operations against Japan, it is believed that they would involve:

(1) Strategic bombing of Japanese industry.
(2) Destruction of Japanese shipping.
(3) Softening of island defenses preparatory to invasion.
(4) Invasion operations.

b. In connection with each of these operations, the following functions of HABBAKUK II were considered (See ANNEX "C" for analysis):

(1) Fighter base in support of amphibious operations.
(2) Base for naval types of torpedo and dive bombers.
(3) Advance landing ground for bomber operations.
(4) Staging point on ocean air routes.
(5) Staging point for airborne troop operations.

8. Practical Operations From HABBAKUK II.

a. All Naval aircraft designed for carrier service now under procurement or contemplated can take off with maximum over-load in less than 2,000 feet without the assistance of wind, jet, or catapult. From an estimate of hangar space probably available, approximately 260 Naval aircraft in suitable proportions of type could be landed with the aid of arrester gear,

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and stored below deck for protection and maintenance. By way of comparison it is noted that the capacity of Essex class carriers is 90 aircraft.

b. The deck of HABBAKUK II is too short for practical operations of Army aircraft by average pilots. (See ANNEX "B"). Army Aircraft cannot be "fitted" with landing arrester gear, since this accessory must be incorporated in the original design of the airplane.

9. Capacities of HABBAKUK II to Absorb Punishment.- See ANNEX "D" for opinion of the Ordnance Department, U.S. Army, regarding Pykrete construction. The personal opinion of Mr. L. A. Kniskern, head of the Design Section, Bureau of Ships, Navy Department, regarding Pykrete construction is appended as ANNEX "E". It was found that insufficient engineering data regarding Pykrete was available to permit a rigid analysis. According to the British claims, forty feet of Pykrete would be the equivalent of sixteen feet of the best reinforced concrete. A consensus of experts consulted in the Navy Department holds that the vessel would not be indestructible, or impenetrable in fact. Further, it is difficult to predict the effect of heat generated by friction and explosive action accompanying impact by bombs or projectiles. A determined bombing attack on the deck of HABBAKUK II may not sink the vessel, but it would certainly destroy the deck to such an extent that repair would be impracticable and perhaps impossible. There are many problems pertaining to damage control on a vessel of this type, which remain to be solved, and no reliable prediction can be made at this time in regard to how much damage the vessel could probably withstand and still accomplish its mission. Extensive practical tests of the effect of bomb and projectile impact on representative samples of Pykrete should be conducted.

10. Although this study assumed that HABBAKUK II has successfully passed operational trials, it should be noted that whenever a new ship, and particularly the first of a new class, is placed in commission, Naval experience has demonstrated the need for an extensive development period beyond final design and actual construction to eliminate defects that limit its operating efficiency. This period, in the case of a radically new design like HABBAKUK II, will certainly be long.

III. CONCLUSIONS.

11. The proposed vessel will be an enormous ship displacing about 2,000,000 tons, but a tiny airdrome only 2,000 feet long. It will possess less power of defense than a carrier, but greater resistance to damage. A maximum speed of seven knots makes it tactically impracticable for a protective Naval escort to accompany the vessel during its passage, or to remain nearby while on station. An overnight (12 hours) cruising range of only 84 miles precludes its use in surprise actions. It will lack some of advantages of an island airdrome and will share the same disadvantages in respect to immobility and dependence on other vessels for supplies and protection.

12. If used at all, HABBAKUK II will be employed in the war against Japan in 1945.

13. The probable strategic situation and availability of aircraft carriers and long-range bombers by mid-1945 will operate to limit the utility of HABBAKUK II to employment as staging points on the ocean airways in connection with ferrying operations.

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14. Its use for other purposes and in connection with other types of operations is tactically feasible, but would overlap functions that could be performed as well, if not better, by aircraft carriers and long-range bombers operating from continental and insular bases.

15. The value of HABBAKUK II in any tactical role will depend ultimately upon its ability to absorb punishment, and the efficiency of damage control procedures developed to repair damage sustained under a determined enemy attack. These, in turn, depend upon the structural properties of Pykrete, and the method of construction.

16. The Pykrete walls, bottom, and deck of HABBAKUK II are claimed to be equivalent to 16 feet of the best reinforced concrete. This claim is open to question, since actual tests of the ability of Pykrete to resist damage by bombs and projectiles have not been made. The claim is based upon theoretical considerations and small scale tests of its durability.

17. According to British estimates, it will require about one year to construct HABBAKUK II. After construction, an extensive testing and development program will be required to develop an efficient vessel that can deliver the performance originally intended. These tests will extend over a long period of time, since absolutely no backlog of experience exists on which to base a testing and development program.

18. When examined in the light of the probable strategic and combat material situations that will exist in mid-1945, this project appears less attractive than initial studies might have indicated.

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ANNEX "A" TO APPENDIX "B"

Length	2,000 feet.
Beam	300 feet.
Draft	150 feet)
Freeboard	50 feet) --Overall Depth: 200 feet.
Speed	7 knots (maximum)
Propulsion	26 electric motors of 1,100 HP each, housed in pressure hulls, 13 along each side of vessel. Each motor drives a propellor of 14 ft. diameter.
Power Supply	32,000 HP, derived from diesel or turbo-electric generators located in two main central compartments of the vessel.
Fuel Data	Fuel oil capacity ..... 5,000 tons Consumption at 7 knots ... 120 tons a day Endurance at 7 knots ..... 41 days, 16 hours Range at 7 knots ..... about 7,000 nautical miles.
Displacement	About two million tons.
Minimum Thickness of Pykrete hull	40 feet. (Claimed by the British to be equivalent in protective properties to 16 feet of the best reinforced concrete.)
Refrigeration	16 refrigerating plants, totalling 3,600 to 3,900 HP, are required to maintain the Pykrete skin surface at a temperature of 5° F. (-15° C.) under tropical conditions. This temperature is to keep the material from "flowing", and to provide the necessary structural strength.
Hangar Space Below Deck That Could Be Provided	300,000 to 330,000 square feet.
Naval Aircraft:	All Naval aircraft designed for carrier service under procurement or contemplated. A total of about 260 Naval airplanes (folding wings) can be accommodated in hangar deck.
Army Aircraft:	About 7 fighter squadrons (175 planes) or 4 medium bombardment squadrons (52 planes). Types of aircraft as listed in ANNEX "B".

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Capacity to Resist Various Forms of Attack . . . . . (See ANNEXES "C" and "E")	Penetration by projectiles will be approximately 2½ times further than in reinforced concrete.
	Probable size of torpedo crater -- 3 ft. deep, 16 to 20 ft. across.
	Penetration of 1,600 lb. AP bomb -- 16.8 ft. (calculated).

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ANNEX "B" TO APPENDIX "B"

TAKE-OFF AND LANDING CHARACTERISTICS OF ARMY AIRCRAFT

I. Discussion

1. The Assistant Chief of Air Staff, Operations, Commitments and Requirements, Headquarters, Army Air Forces, was requested to submit a report showing what combat and transport aircraft could be landed on, and taken off from HABBAKUK II. The following information was elicited:

a. Fighter

For practical operation of P-38G, P-38D, P-40F, P-47D, P-63, and P-51 aircraft, the minimum necessary landing distance is estimated to be 3,500 feet. A clear deck width of 400 feet would be desirable, but it is believed operations could be conducted from a deck having only 300 feet width, if roll of the seadrome is not excessive.

b. Bombardment.

(1) For practical operation of A-20G, A-26, B-17E, B-24D, B-25G, and B-26C aircraft, the minimum required landing distance is estimated to be 3,500 feet. A 300 foot deck width is considered adequate.

(2) It is probable that unassisted take-offs of all the aircraft listed could be accomplished from a 2,000 foot seadrome with an eight miles per hour wind. However, a rough check of the load which a B-17E could carry under these conditions indicates that the bomb load would be approximately 1,000 pounds for a radius of action of 250 miles. Other models would have similar load limitations.

c. Transport

(1) For the practical operation of C-46, C-47, and C-54 aircraft, a landing deck distance of over 2,000 feet would be required. (The actual minimum required distance would require careful investigation.) No values for the C-82 can be given at this time since the aircraft has not been flown.

(2) A deck width of 300 feet is considered ample, and a minimum of 200 feet width could be utilized.

(3) The following weights are recommended:

C-46	48,000 lbs.
C-47	30,000 lbs.
C-54	60,000 lbs.

II. Conclusions

2. It is concluded that a landing deck only 2000 feet in length would be too small for the practical operation of Army aircraft by average pilots.

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ANNEX "C" TO APPENDIX "B"

NOTE: Considering the expected availability of aircraft carrier by the middle of 1945, it was agreed that the carrier would be a better weapon than HABBAKUK II for use as a fighter base in support of amphibious operations, and as a base for naval types of torpedo and dive bombers. These functions were therefore eliminated from further consideration.

OPERATIONS / FUNCTION	ADVANCE LANDING GROUND FOR BOMBER OPERATIONS	STAGING POINT ON OCEAN AIR ROUTES	STAGING POINT FOR AIRBORNE TROOP OPERATIONS
STRATEGIC BOMBING OF JAPANESE INDUSTRY	If employed in sufficient quantities HABBAKUK II would be extremely effective in these operations. For purposes of self defense, as well as implementing the requirement for mass action, approximately 4 HABBAKUKS should be organized into a self-supporting defensive element; at least 4 of these elements would be required. In contrast to this scheme it is believed that long-range bombing operations from the mainland or appropriate island bases would be more effective, as well as simpler, from the operational standpoint.	Existing plans contemplate that by 1945 we will have recovered control over the Marshalls, Gilberts, possibly part of the Carolines, Wake, the Solomons and New Guinea. The western termini of air ferrying routes across the Pacific will undoubtedly be anchored at various points in these islands. In this case, HABBAKUK II could be employed to provide staging points to fill in over-water hops in excess of 600 to 700 miles. If ferrying operations attain any great volume, two or more HABBAKUKS would have to be spotted at each staging	Not applicable.

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DESTRUCTION OF JAPANESE SHIPPING	While HABBAKUK II could be employed in anti-shipping operations, it is felt that the aircraft carrier, due to its high mobility, is a better weapon for this purpose.	point, and consequently HABBAKUKS employed on this mission would require frequent attention on the part of fleet units -- a strong disadvantage from the standpoint of the fleet. Furthermore, once their presence became known they could be subjected to frequent and determined attacks which would seriously limit their utility.	
SOFTENING OF ISLAND DEFENSES, PREPARATORY TO INVASION	Tactically, HABBAKUK II would undoubtedly be of great value in supporting these operations, but no more so than carriers. Due to the latter's mobility and capacity for surprise action, it is felt that they would be of greater value in this type of operations than HABBAKUK II.		Considering the Pacific si mid-1945, it is believed t chute and airborne troop o could be conducted from Co and Island base facilities possession at that time. I therefore felt that little exist for employment of HAB in this role.
INVASION OF JAPAN			

CONCLUSIONS: In general, it is believed that HABBAKUK II could be most usefully employed as:

(1) an advance landing ground for bombing operations in connection with:

(a) strategic bombing of Japanese industry.
(b) pre-invasion and invasion bombing operations.

(2) staging points on the ocean air routes.

Strategic bombing of Japanese industry could be conducted from continental and insular bases, using long-range bombers. Pre-invasion and invasion bombing operations could be conducted with long-range bombers and aircraft carriers. In the light of these considerations, it would appear that the principal value of this project would be derived when used as staging points on the ocean air routes, in which role it would be unique.

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ANNEX "D" TO APPENDIX "B"

To insure prompt atten
in replying refer to:

WAR DEPARTMENT
Office of the Chief of Ordnance
Washington, DC

O.O. No. 471.6/594(S)
Atten of
SPOTM
Bomb & Pyro. Section

20 July 1943

Subject: Project H-2.

To: Assistant Chief of Air Staff, Plans
Army Air Forces
Washington, D. C.

ATTENTION: Colonel F. O. Allen, Room 3-E-1076.

1. Reference conference, 19 July 1943, at which Colonel F. O. Allen, of Army Air Forces, and Lt. Col. R. G. Butler, Jr. and Mr. H. S. Beckman of the Ordnance Department were present, the following comments of the Ordnance Department are forwarded for consideration:

a. Using Petry's formulas for penetration of bombs (including effect of explosive): $D = 3\,kPV''$

in which D = depth of penetration plus added depth of crater due to explosion of the bomb.

$3 = \sqrt{\frac{\text{Ultimate Crushing Strength}}{\text{Ultimate Tensile Strength}}}$

k = A penetration constant (assumed to be 11.9×10^{-3} (i.e. 2½ times the value of 4.76×10^{-3} which applies for reinforced concrete)).

P = Weight in pounds divided by cross-sectional area of the bomb in square feet.

V'' = A value dependent upon velocity and equal to .752 for striking velocity of 1000 feet per second.

For a 1600-lb. A.P. Bomb with 14" diameter:

$$D = \sqrt{\frac{1100}{700}} \times \left(\frac{2.5 \times 4.76}{1000}\right) \times \frac{1600}{1.07} \times .752 = 16.8 \text{ ft.}$$

$$= 1.253 \times .0119 \times 1494 \times .752 = 16.8 \text{ ft.}$$

It thus appears that a 1600-lb. A.P. Bomb, as above, would penetrate approximately 16.8 feet into a heavy structure of the proposed material.

b. Tests at Aberdeen Proving Ground against concrete targets, and calculations based thereon, indicate penetration approximately 5 and 6 feet for a 1600-lb. and for a 2000-lb. bomb, respectively, for penetration alone; added to this figure approximately 2 feet more should be included

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for blast effect. The total depth of crater would then be 7 and 8 feet respectively, for penetration into good quality reinforced concrete. Using the factor of 2½ as indicated for penetration into the proposed material, and applying this factor to the explosive effect as well as to penetration before the explosion takes place, a total depth of approximately 17½ to 20 feet may be expected for the above bombs.

c. The Ordnance Department is not as familiar as the Navy Department with the effects of torpedo explosions. The depth of 3 feet quoted as an expected depth of crater after a torpedo hit does not appear to be too far afield if the material actually performs as outlined. The 16-foot diameter quoted for such a crater is somewhat wider than the Ordnance Department had expected. However, if the crater should happen to be slightly deeper and narrower, or to vary otherwise within reasonable limits, the overall effect on the structure would be approximately the same.

d. From the dimensions shown in Diagram I, Plans View, it appears that less than 7% of the horizontal projected area would be affected even if the bomb in its explosion resulted in a penetration of 40 feet. This would still not accomplish sinking of the structure.

e. From the above, it would appear that the structure would not sink under other than repeated impacts with bombs or torpedoes. The information at hand did not show any results of firing tests, either for penetration alone or for penetration plus explosive effect following such penetration. Information on the material, as to the brittleness or sensitivity to shock, was also lacking. Further this office has no way of evaluating the effect of the refrigeration pipes or other parts of the structure, as far as these features might tend to introduce cleavage planes. Since it is assumed that the penetration and strength features furnished in Section V of the report are based on tests, it appears that at least some scale model tests must have been conducted.

2. It is recommended that further information be obtained from the British Government and from the Navy Department reference the points mentioned in 1 d above. If such information is not adverse, there appears to be no cogent reason, from the Ordnance point of view, for not proceeding with the project.

For the Chief of Ordnance:

(S)
R. G. BUTLER, JR.,
Lt. Col., Ord. Dept.,
Assistant.

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ANNEX "L" TO APPENDIX "L"

NAVY DEPARTMENT

BUREAU OF SHIPS
Washington, D.C.

July 22, 1943

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MEMORANDUM

From: Head of the Preliminary Design Section, Bureau of Ships.
To : Captain D. Ketcham, U.S.N., Bureau of Aeronautics.

Subject: Proposed "Pykrete" Construction - Resistance to Various Forms of Attack.

Enclosure, herewith.
(A) British Most Secret Document P/1477, page 26, and diagrams Nos. 1, 2 and 3.

1. Enclosure (A), which you left in my office on July 20, 1943 with a request for comment as to the protective value of this type of construction, is returned herewith.

2. The Ship Protection Group of the Preliminary Design Section, being primarily concerned with the protection of steel ships, has very little information which would be useful in estimating the resistance to various forms of attack of the so-called "Pykrete" construction partially described in enclosure (A). There is no information whatsoever in this section as to the effects of underwater explosions in contact with concrete or similar materials. My personal opinion is that if this material has the mechanical properties claimed for it, and if the structure described will hold together as a ship under normal stresses imposed by the sea, it is quite possible that the 40' sides would effectively resist the contact explosion of a torpedo, assuming a normal charge of about 600# of T.N.T. There is absolutely no evidence available to this section, however, to substantiate such an opinion. Moreover, my statement of this opinion should not be taken in any way as an indication that I consider the proposed type of construction to be practicable or acceptable.

3. It is noted that the proponents of this scheme state that penetration of projectiles is estimated to be "2½ times further than in concrete". In tests made by the Panama Canal Authorities (Department of Operation and Maintenance, Special Engineering Division, Balboa Heights, Canal Zone), a 16" projectile with a striking velocity of 2000 ft.sec. completely penetrated 23' of concrete which was well reinforced. A crater 9' in diameter and 3' deep was left on the front face. In tests conducted by the British War Department a 500# S.A.P. bomb, inert-loaded, penetrated 23" into a 10' x 10' x 4' thick reinforced concrete block. In another British test a 9.2" shell, weighing 400# and with a striking velocity of 1290 ft.sec., completely perforated a heavily reinforced concrete block 4' thick. One of the British conclusions from these tests was that the depth of penetration into a thick block of concrete is dependent on the compression strength of the material. It is noteworthy in this connection that the compressive strength of the material used in the Panama Canal was 5950#/in.sq. as compared with 1100#/in.sq. claimed for "Pykrete" in enclosure (A). It is not known whether the penetration varies inversely

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with compressive strength, but it appears that this is probably the case. If so, it would be expected that a given projectile would penetrate approximately 5 times as far in "Pykrete" as in heavily reinforced concrete. This statement, of course, assumes that "Pykrete" is a material which can be built up in blocks and bonded together is claimed in enclosure (A) to give a resultant mass having the mechanical properties claimed.

/s/ L. A. Sniskern

L.A. SNISKERN.

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APPENDIX "C"

J.P.(43) 244 (Final)

23rd JULY, 1943

WAR CABINET

JOINT PLANNING STAFF

HABBAKUKS FOR WAR AGAINST JAPAN

Note by the Joint Planning Staff

In anticipation of instructions, we have prepared and attach as an Annex an appreciation on the use of Habbakuks for the war against Japan. In drawing up this appreciation, we have consulted members of the Habbakuk Committee, taken into account the report of the Main (Technical) Committee, and have discussed the subject with the United States Planning Team recently in this country. The latter have taken with them to Washington, descriptions of some of the various Habbakuk designs.

2. The various types of Habbakuks we discuss in this paper are:-

HABBAKUK I

A very slow vessel. Speed: 2 to 4 knots in tow. Made of

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wood. Length; 1500 ft. Breadth: 250 ft. Small size of flight deck and low speed rules out use of larger aircraft, and necessitates the use of arrester gear for nearly all types. No aircraft accommodation. Earliest that one could be made available is summer 1944.

HABBAKUK II

Large and fairly slow. Speed 7 knots. Self-propelled. Length 1700-2200 ft. Beam sufficient to operate and park medium bombers and transport aircraft and perhaps heavy bombers. Can be made of steel but would require a lot of it. Would be better in pykrete (frozen pulp) but for this experimental sections would have to be made. This could be done in the winter of 1943/44 and if successful the first pykrete Habbakuk II might be operational by mid 1945, but there are a large number of constructional and operational problems to be overcome.

HABBAKUK III

A smaller and faster type. Speed 12 knots. Made of steel and timber. Length: from 1000 to 1200 ft. Beam sufficient to operate fighters, naval aircraft and light twin engine bombers. If a definite order is given in the near future, the first could be operational by the spring of 1945.

APPENDIX "C"

3. We are of the opinion that Habbakuks II and III, particularly III, will be of the greatest value in the war against Japan, and will be preferable to the increase of Escort Carriers beyond a certain point. Habbakuk I is too slow, and should only be constructed if required for a specific operation.

4. Since it will be impossible to undertake construction of any Habbakuks in the United Kingdom, we recommend that we should press the United States, Canadian and Australian Authorities to undertake the following programme:-

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(a) The earliest possible construction of as many as possible of Habbakuk III for use in both the Indian Ocean and the Pacific.

(b) The construction during the coming winter of sections of pykrete for Habbakuk II for experimental purposes.

(c) Subject to success in (b) the construction of as many as possible of Habbakuk II in pykrete during the following winter for use in the Pacific.

5. If these recommendations are approved we suggest that:-

(a) The British Planning team now in the U.S.A. preparing the appreciation and plan for the defeat of Japan should be instructed to explain its strategic and operational potentialities to the U.S. Naval Authorities.

(b) A representative of the Habbakuk Committee should be sent to Washington at once to explain the scientific and constructional potentialities and assist in investigating procedure for design and construction. It is understood that Professor Burnal could undertake this task.

(c) The possibility of additional construction in Australia should be investigated.

(Signed) C.E. Lambe
W. Porter

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F.S. Jackson Taylor

Offices of the War Cabinet,
S.W.1.

23RD JULY, 1943.

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A N N E X

REQUIREMENTS OF HABBAKUKS FOR THE WAR

AGAINST JAPAN

Requirement for Aircraft Carriers of all sorts

Our projected plans for the defeat of Japan involve a very long series of amphibious assaults towards the coast of China, a land campaign in China to secure airfields for the prolonged and intensive bombing of Japan, followed ultimately by a number of major amphibious assaults against the Islands of Japan itself.

2. If this whole process has to be undertaken step by step, the defeat of Japan is not likely to be achieved in less than five or six years after the defeat of Germany. It is of great importance to speed this process up. The only ways of doing this are:-

(a) To increase the size of the steps of our amphibious advances, the main limiting factor in which is the effective range of shore based air support.

(b) To accelerate the bombing of Japan by the use of ship-borne aircraft to augment that by shore-based aircraft, which must necessarily be undertaken at very long range and will, for some years, be on a light scale only.

3. The extent to which these two measures can be achieved depends almost entirely on the number and efficiency of the aircraft carriers of all sorts that we can provide. Aircraft and air personnel we shall have in abundance after Germany has been defeated, but air

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pacted against the enemy will be severely limited.

4. Any increase in numbers or efficiency of our aircraft carriers will therefore have a direct effect on the time taken to defeat Japan.

Functions to be undertaken by Aircraft Carriers

5. The functions which are required to be undertaken by aircraft carriers of various sorts are as follows:-

(a) To destroy the Japanese Fleet, and provide cover for our operations and communications.

(b) To carry out raids on Japanese back areas and in particular shipping, bases, sources of raw materials and industries in Japan.

(c) As escorts for our convoys to protect them against attacks of all sorts, particularly by aircraft.

(d) To provide fighter and tactical bomber support in amphibious operations.

(e) To enable long range amphibious operations to be supported by airborne troops flown from reasonably short distances, so that they are not unduly fatigued before being dropped.

(f) To augment or extend our shore based aircraft in support of defensive operations, such as the holding of small island bases after they have been captured.

(g) The supply of Naval and fighter aircraft to the battle area, the aircraft carriers acting either as staging points or as ferries.

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Attributes for performing required functions

6. To perform the above functions each type of aircraft carrier requires in a varying degree:-

(a) Ability to fly aircraft on and off.

(b) Strategic Mobility.

(c) Protection from enemy attack.

These requirements are provided for by the three attributes, speed and size and invulnerability in varying combinations according to the function to be fulfilled.

7. It is the combination of speed and size which gives them the ability to fly aircraft on and off. In the case of the Fleet Carrier, its high speed enables it to be comparatively small. At the other end of the scale the stationary or very slow Habbakuk I because of its lack of speed will require vast size to enable aircraft to fly on and off.

8. It is speed which, of course, determines the degree of strategic mobility provided. In the case of the Fleet Carrier, it is very great. In the case of the Habbakuk it will be very small, and if the direction of the wind is unfavourable, strategic mobility may be almost lost altogether unless the operation of aircraft on passage is foregone altogether, since the vessel must turn up into the wind whenever aircraft are flying on and off.

9. It is the combination of speed, size and invulnerability of construction which give the aircraft carrier the required protection from enemy attack. In the case of the Fleet Carrier, this immunity is provided by high speed, a reasonably small target, fairly good under-water and armour protection and the distribution

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of the "eggs" amongst a fair number of "baskets." In the event carriers, the lack of speed and protection is to some extent made up for by distributing the "eggs" in very large numbers of "baskets." The large, slow, unmanoeuverable Habbakuk will, on the other hand, be extremely easy to hit with torpedoes and bombs and many "eggs" will be contained in each "basket." It must, therefore, be constructed with material of great strength to enable it to continue in operation, in spite of the hits which it is likely to receive.

Possible Functions of "Habbakuks"

10. If the aircraft carrier functions enumerated in paragraph 5 above, clearly Habbakuks cannot operate with the Fleet (function (a)) owing to their lack of mobility.

During the advance to, and retirement from an operation the Habbakuk will, therefore, normally require an aircraft carrier escort, in addition to A/S and possibly surface escort.

11. To carry out raids on Japanese industries etc. (Function (b)) Habbakuk could be used in one of three ways:-

(i) As a carrier operating aircraft in the normal way.
(ii) As a carrier, carrying the aircraft to the flying-off position, launching them, but the aircraft then returning to a convenient shore base; or

(iii) As an advanced landing ground for refuelling aircraft operating from bases further back, thus extending their radius of action.

12. For (i) aircraft must be capable of being stowed below, both for maintenance and for protection against enemy attack. To enable reasonably large numbers to be employed, comparatively small types of aircraft should therefore be used.

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13. The use of short-range single-engine Naval types of aircraft, combined with the comparatively low speed of any "Habbakuk" would, however, make the achievement of surprise difficult. A long-range light twin-engine bomber (e.g. the Mosquito type) capable of operating without fighter escort, would therefore be more satisfactory for this type of operation, and the "Habbakuk" would require a speed of not less than about 12 knots.

14. At this speed a Mosquito requires a flight deck of not less than 1,200 ft. without assisted take off.

15. For (ii) and (iii) above, aircraft need not be maintained on board, and protection from enemy action could be dispensed with for the limited period that they are on board.

16. Stowage for aircraft between decks becomes, therefore unnecessary and the use of larger aircraft would not be uneconomical. These methods may, therefore, provide the opportunity for taking advantage of the long range and heavy loads of medium and heavy bombers.

17. For this type of operation a speed of about 7 knots should be sufficient, and at this speed the length of deck required is as follows:-

Medium Bombers: about 1,500/2,000 ft. without assisted take off

Heavy Bombers: about 2,200 ft. without assisted take-off.

18. Owing to the undesirability of attacking in small numbers, it will be necessary for the bombers to take off, and in the case of (iii), land-on with a number of aircraft on deck. A vessel of considerable beam will therefore be necessary.

19. Even so, arrester gear will, almost certainly, be necessary to avoid collision with aircraft on deck. The provision of this

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gear for large aircraft, and the strengthening of the latter will require investigation but should not be insoluble.

20. For escorting convoys. (Function (c)) a speed of at least 15 knots and fairly good manoeuvrability is required to enable the vessel to regain the convoy when the direction of the wind has necessitated steering away from it while operating aircraft.

21. Although not definitely ruled out for this function, the Habbakuk is not very suitable for it, and should not, therefore attempt it at present.

22. For Fighter and tactical bomber support in amphibious operations Function (d). there is clearly great scope for "Habbakuks" to reinforce the escort carriers on which we must otherwise mainly rely, until the destruction of the Japanese Fleet frees our Fleet carriers for this purpose.

23. For this function a speed approaching that of the slowest convoy to be used in the operation is important, otherwise the success of the whole operation may be seriously prejudiced due to loss of surprise. A speed of, or nearly, 12 knots is required.

24. Since large numbers of small aircraft, as opposed to a small number of large aircraft, are best for this function, a vessel of comparatively small size would be acceptable in order to achieve the speed required and fighters and naval types of bombers would be suitable.

25. For a 12-knot vessel these aircraft require a deck of at least 1,000 ft. in which to take off without assisted take-off.

26. Arrester gear must almost certainly be used for landing on, regardless of the length of the vessel, in order to avoid collision with aircraft parked on deck.

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27. The beam of the vessel need not necessarily be greater than that required to operate single engine types, but a broad flying deck will of course enable more aircraft to be carried and operated.

28. Stowage for aircraft below must be provided both for maintenance and for protection against enemy attack.

29. For launching airborne troops in support of amphibious operations (function (e)) fleet or escort carriers are of little vlue due to the small number of troops that can be carried in Naval types of aircraft. The "Habbakuk" appears to offer the only practicable alternative.

30. Since it would be quite satisfactory to launch our air-borne forces at a distance of 3/400 miles from the objective, at a time when our assault convoys are approaching it, a speed considerably less than the latter would be acceptable in this case without prejudicing surprise. About 7 knots is considered acceptable.

31. To fly off a medium type of transport aircraft (e.g.C.47 carrying 12 men), from a vessel of 7 knots, a flight deck would be required of at least 1,700 ft. without assisted take-off.

32. To carry and operate a reasonable number of such aircraft a vessel of considerable beam will be necessary. Again, arrester gear will almost certainly be necessary unless aircraft are able to return direct to a shore base.

33. For the defence of Island bases (function (f)) any of the types already described will be suitable. An engine-less "Habbakuk," moored in a sheltered and tideless harbor, free to swing to the wind, might also be of value in islands where airfields are lacking.

34. To operate fighter and naval types, a stationary "Habbakuk" of this type would have to be at least 1,500 ft. long without assisted take-off.

35. For the supply of naval and fighter aircraft, whether acting as staging points or ferries, any of the mobile types referred to above would be suitable, and the engine-less type could also be used as a staging point, either permanently at anchor in harbour or temporarily at sea with tugs to keep it head to wind.

Conclusion on types of "Habbakuk" required

36. It appears from the above that the following types of "Habbakuk" would be of value. In all cases it is assumed that arrester gear must in any case be provided, but no reduction in length is allowed for assisted take-off.

(a) About 1,000 ft. long. Speed about 12 knots. Beam sufficient for operating large numbers of fighter and naval aircraft. Protected stowage required for a considerable proportion.

(b) About 1,200 ft. long. Speed about 12 knots. Beam sufficient for operating light twin-engine bombers. Protected stowage required for considerable proportion.

(c) About 1,500/2,000 ft. long. Speed about 7 knots. Beam sufficient for operating fair numbers of medium bombers and transport aircraft. No stowage required.

(d) About 2,200 ft. long. Speed about 7 knots. Beam sufficient for operating fair numbers of heavy bombers. No stowage required.

(e) About 1,500 ft. Engine-less. Beam sufficient for operating fighter and naval aircraft. Protected stowage required for defence of base, but not for use as staging point.

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37. (e) should only be built if required for a specific operation, for which the wooden "Habbakuk I" appears to be the most suitable since it can be built rapidly (about 6 Months) and for temporary use. The only possible requirement for it in the British sphere of responsibility appears to be as a staging point in the Bay of Bengal for the supply of naval aircraft during operation "Culverin." No decision on this is as yet possible or necessary.

38. The remaining types could be reduced to two, one for requirements (a) and (b) and one for (c) and (d), the former being given first priority since the operation of fighter and naval types from carrier decks is already proven, and fighter and tactical support for amphibious operations is a matter of first importance.

39. There is, therefore, a requirement for two types of Habbakuk:-

1st (Habbakuk III) A vessel of:

(i) length about 1,000 - 1200 ft.;

(ii) speed as near 12 knots as possible;

(iii) sufficient beam to operate fighters and naval aircraft and light twin-engine bombers;

(iv) protected stowage for aircraft;

2nd (Habbakuk II) A vessel of:

(i) 7 knots;

(ii) length at least 1,700 ft. and if possible about 2,200 ft.;

(iii) sufficient beam to operate and park medium bombers and transport aircraft, and heavy bombers if length of 2,200 ft. proves possible;

(iv) protected storage for aircraft not required;

Assisted Take-off

40. For efficient operation of all types of aircraft which can use Habbakuk II and III it is more than likely that assisted take off methods and arrester gear will have to be used. By these means it should be unnecessary to rely entirely on the need for natural wind, and errors caused by pilots without fleet air arm training or resulting from battle damage to aircraft or the vessel itself should be reduced to a minimum.

41. The employment of these methods requires detailed investigation but may, if successful, allow a reduction in deck lengths. Although the greater the deck length the more likely the success of operations, the problem of reduction should be investigated in closest collaboration while final designs are being produced by the Habbakuk Main Technical Committee.

Types of Construction

42. From the Report of the Main Technical Committee on "Habbakuk" and further discussion with members of this Committee, we understand that:-

(a) Habbakuk III, the smaller and faster type, could best be made in steel and timber, and would take about 15 months to construct. Successful construction could be relied on without building any prototypes or experimental sections, and if a definite order is given in the near future they should be operational by the Spring of 1944.

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(b) Habbakuk II, the larger and slower type could be built in steel, but would require a very large quantity of it; it is more suited to construction in pykrete, but could not be built in this material with any reliability without first constructing sections for experiment. Experimental sections could be built next winter and if successful the first pykrete Habbakuk might be operational by mid-1945 at the earliest, but there are a large number of constructional and operational problems to be overcome.

(c) In comparison with a large number of escort carriers, for a given number of operational aircraft, a small number of the smaller steel and timber Habbakuk III's referred to above, would require:-

(i) Less steel, and steel of a type more easy to obtain.

(ii) Less horsepower and certain of the engines would be of a type more easy to obtain.

(iii) Less labour, and labour of a type which will shortly be freed from other war constructional projects and thus would not compete with existing shipbuilding commitments.

(d) The present shortage of steel is unlikely to remain a really serious bottleneck for long, anyhow after the defeat of Germany.

(e) Good protection from the torpedo and bomb hits which we must expect will be inherent in the large Pykrete vessel. The effect of hits on the steel and timber Habbakuk III will be greatly minimised, in comparison with normal ships, by the following factors:-

(i) By the provision of a number of independent propulsion units.

(ii) The use of plastic armour of great thickness which, unlike normal ships' armour, is easy to provide and fit.

(iii) Under-water protection by such methods as sub-division, backed by plastic armour, used to a much greater extent than is possible in a normal ship, there accessibility to all compartments is required.

43. For operational reasons, we consider that the provision of a smaller number of "Habbakuk" would be preferable to a very large number of small escort carriers, because:-

(i) Coordination and forming up of aircraft flying from a smaller number of vessels would be simplified.

(ii) The sea room required for handling the vessels would be greatly reduced and thus concentration, control and mutual support gained.

(iii) The extreme vulnerability of our escort carriers is bound to be bad for morale when operating against shore-based aircraft, and this counter-balances to a large extent, the advantage they gain from the "eggs" being distributed among a very large number of "baskets."

Conclusions

44. We conclude, therefore, that:-

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(a) Even if the building of steel and timber Habbakuk III's should eventually prove to compete in steel, labour, etc. with an expansion in the present building programme of escort carriers it would be desirable to construct at least a certain number of them at the expense of the latter.

(b) To meet the requirement of a large mobile landing platform without using large quantities of steel and to exploit the inherent protective properties of Pykrete, the development of the large Pykrete type (Habbakuk II) is very desirable.

45. Owing to the lack of labour, and timber, none of the three types of Habbakuk can be constructed in the United Kingdom. The results of our scientific investigations should therefore be put at the disposal of the United States, Canada and Australia where these difficulties can be overcome.

Recommendations

46. We therefore recommend that the United States, Canadian and Australian authorities be pressed to collaborate forthwith with the Habbakuk designers and the appropriate naval and air authorities, with a view to:-

(a) The earliest possible construction of as many as possible of the small, fast Habbakuk III in steel and timber for use in both the Indian Ocean and the Pacific.

(b) The construction during the coming winter of the sections of Pykrete required for experimental purposes.

(c) When and if success in (b) is achieved the construction of as many as possible of the large slow type of Habbakuk II in Pykrete for use in the Pacific.

47. We also recommend that the construction of Habbakuk I be undertaken only if specifically required for a definite operation (See also J P.(43)230 Final).

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HABBKUK II STUDY

145.81-154
Aug 43-Mar 1944
RETURNED TO THE ARCHIVES OF THE AAF HISTORICAL OFFICE
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BY AUTHORITY OF A.C. OF S., OPD

WAR DEPARTMENT GENERAL STAFF
DISPOSITION FORM

21 Feb 44 (Date) JCW (Initials)

AG
G- OPD 600.12 Sec (18 Feb 44)

SUBJECT HABBAKUKS and TENTACLES
(CCS 315.11)

Date 21 February 1944

TO	___ C/S	___ G-1	___ G-2	___ G-3	___ G-4	___ Air Staff
	___ TAG	___ OPD	___ USW	___ ASW	___ ASWA	___ CG _____ Army
	___ AC	___ BLP	___ BOWD	___ ExRA	___ NGB	___ CG ___ Army Corps
	___ INF	___ FA	___ CAV	___ CA	___ ENGR	___ CG ___ CA
	___ ORD	___ QMG	___ CSO	___ SG	___ FIN	___ CG _____ DEPT
	___ GHQ	___ JAG	___ CWS	___ IG	___ B/PR	X CG, AAF

FOR	___ S/W directs	___ Comment or Concurrence	___ Necessary action
	___ Draft of reply	___ Remark and recommendation	___ Information for reply
	___ Direct reply	___ Inviting attention to	___ Ind. approved
	___ Approved	___ See notation of _____	___ Primary interest
	___ Disapproved	X Information	___ Notation and return
	___ File	___ Consult _____	___ Noted _____

BY ___ Spcl Msgr ___ Radio ___ Air Mail ___ Immed. Action Ltr ___ Letter. . . .

1. In CCS 315/11, subject as above, the representatives of the British Chiefs of Staff stated that, "Since....it appears evident that the U.S. Chiefs of Staff do not propose to build even HABBAKUK III in the U.S., the British Chiefs of Staff agree to drop the project, though with some regret." The representatives of the British Chiefs of Staff went on to say "The question of TENTACLES is still under consideration by the British Chiefs of Staff."

2. Combined Chiefs of Staff in their 146th meeting, 18 February 1944, took note of CCS 315/11.

3. Similar Disposition Forms have been furnished AC/S G-4 and CG, ASF.

J. K. WOOLNOUGH,
Lt. Col., G.S.C.,
Chief, Policy Section.

THOS. T. HANDY,
Major General,
Assistant Chief of Staff.

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IN REPLY ADDRESS
THE BUREAU OF YARDS AND DOCKS
AND REFER TO No.
(SC)N16-3/A1-1
D-1/rm
YD Serial 01381

NAVY DEPARTMENT
BUREAU OF YARDS AND DOCKS
WASHINGTON, D. C.

SECRET

1 January 1944

From: Chairman, Habbakuk Board
To: Brigadier General Glen C. Jamison, USAAF

Subject: Habbakuks - Board to Construct Section, Continue Design and Study Construction and Facilities for.

1. Forwarded herewith are Enclosures (1) and (2) for your information and consideration.

W.H. Smith
Secretary

Encl. 1. Minutes, Habbakuk Board Meeting No. 4
Encl. 2. Monthly Report No. 8, Habbakuk Board
Copy 8 of 16

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(SC)N16-3/A1-1
D-1/rm
YD Serial 01892

NAVY DEPARTMENT
BUREAU OF YARDS AND DOCKS
WASHINGTON, D. C.

File
Habbakuk

SECRET

22 December 1943

From: Chairman, Habbakuk Board
To: Brig. Gen. Glen C. Jamison, USAAF

Subject: Habbakuk - Board to Construct Section, Continue Design and Study Construction and Facilities for.

1. Meeting No. 4 of the subject Board will be held Friday, 31 December 1943 at 1000 in Room 3601, Navy Building.

W.H. Smith
Secretary

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(SC)N15-5/A1-1
D-1/ds
YD Serial 01589

NAVY DEPARTMENT
BUREAU OF YARDS AND DOCKS
WASHINGTON, D. C.

SECRET

20 December 1943

From: Chairman Habbakuk Board
To: Brig. General Glen C. Jamison, USAAF

Subject: Habbakuk - Board to Construct Section, Continue Design, and Study Construction and Facilities for.

1. Forwarded herewith is Enclosure (1) for information and retention.

W.H. Smith
Secretary

Enc. 1. Habbakuk/Tentacle and Floating Airfields. Papers prepared by the Deputy First Sea Lord's War Cabinet Committee in London. Copy No. 9

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MONTHLY REPORT #3

HABBAKUK BOARD

1. Meeting No. 3 of the Habbakuk Board was held in Room 3601 in the Navy Building at 1000 on 1 December 1943. The monthly report was read and approved.

2. Group Captain James requested that Group Captain F. R. Nost, RCAF, replace him as deputy for Vice Air Marshal Welsh. A letter has been sent to the convening authority recommending approval of this change.

3. There was little discussion at the meeting because there had been no replies to the Board's requests for additional directives nor had any Staff requirements been received from London. It was felt, however, that the Board would receive some definite statement at the close of the Sextant conference.

4. Since the meeting, there have been submitted by Mr. Rivett and distributed to the Board Members, papers prepared by the Deputy First Sea Lord's War Cabinet Committee in London on Habbakuk/Tentacle and Floating Airfields projects. It is stated therein that the Deputy First Sea Lord has formed a British co-ordinating committee in London to deal with these projects and that

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[illegible] has formed a similar committee in Washington to act as liaison between the Board and British authorities in London and Washington. It is the opinion of the Deputy First Sea Lord that the smaller Habbakuk combined with the Tentacle strip is a more practicable proposition than the earlier plan for a Habbakuk exceeding 2000 feet in length. He feels this proposal should receive detailed examination.

5. No meetings of the Board committees were held this month, pending additional directives.

6. At Meeting No. 4, held 31 December 1943, the Board discussed adjournment pending receipt of definite directives from the Combined Chiefs of Staff, as requested previously, on:

(a) The time schedule for completion of work of the Board.

(b) The relative priority of the project as compared to the current ship and shore construction program.

(c) The scope of functions of the Board.

(d) The specific military objectives and military characteristics of Habbakuk II.

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(e) The method of financing.

7. It was felt that issuance of these directives was necessary to maintain the further functioning of the Board, and that further meetings were not warranted until these directives were received.

8. The Board understands that the British Joint Staff Mission received instructions from London to put to the Combined Chiefs of Staff the study of Habbakuk III and Tentacle. The Board observes that before proper study of such problems can be made it is necessary that the staff requirements be determined and modified directives issued.

9. The Board adjourned to await receipt of definite directives on Habbakuk II or modified directives relative to Habbakuk III and Tentacle.

Appendix "A" - Copy of letter YD 01613, 1 January 1943

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NAVY DEPARTMENT

BUREAU OF YARDS AND DOCKS

WASHINGTON, D.C.

(SC)N15-9/A1-1
Habbakuk
D-1

YD Serial 01613

1 January 1944

From: Chairman, Habbakuk Board.
To: Chief of Naval Operations.

Subj: Habbakuk Board Directives.

Refs: (a) Ltr from Board on Habbakuk to VCNO, YD Serial (secret) 01352 of 23 Oct. 1943.
(b) Ltr from Chairman, Habbakuk Board to CNO, YD secret serial 01359 of 23 Oct. 1943.
(c) Ltr from Board on Habbakuk to CNO, YD secret serial 01417 of 27 Oct. 1943.

1. Requests were transmitted by references (a), (b) and (c) that definite directives be obtained from the Combined Chiefs of Staff and furnished to the Habbakuk Board on the following basic matters:

(a) The time schedule for completion of the work of the Board.
(b) The relative priority of the project as compared to the current ship and shore construction program.
(c) The scope of functions of the Board.
(d) The specific military objectives and military characteristics of Habbakuk II.
(e) The method of financing the project.

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2. The Board feels that further meetings of the Board cannot be held to advantage until such directives are furnished it.

3. It is understood that alternative proposals favoring the shorter Habbakuk III, possibly carrying a 3600-foot pontoon flight strip preassembled in large sections, have been received by the British Joint Staff Mission from London for transmittal to the Combined Chiefs of Staff for their consideration.

4. These proposals would have a bearing on the practicability, objectives and characteristics of Habbakuk, and if approved, would necessitate modification of the directives to the Board.

5. It is recommended that the Combined Chiefs of Staff be requested to furnish the Board with the directives which it needs for further consideration of Habbakuk.

/s/ Ben Moreell

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BRITISH JOINT STAFF MISSION

OFFICES OF THE COMBINED CHIEFS OF STAFF

WASHINGTON

TO: Admiral Ben Moreell, U.S.N.,
Chairman of Combined Habbakuk Board.

FROM: J.W. Rivett

SUBJECT: Habbakuk/Tentacle and Floating Airfields.

SUBSECTION: Papers prepared by the Deputy First Sea Lord's War Cabinet Committee in London.

REFERENCE: H/8301

DATE 16th December, 1943.

I have been directed to send you copies of the following papers produced by the Deputy First Sea Lord's War Cabinet Committee on the Habbakuk/Tentacle and Floating Airfields projects.

F.A. (43) 1		27th September, 1943
F.A. (43) 5	Meeting	22nd November, 1943
F.A. (43) 17		15th November, 1943
F.A. (43) 18		23rd November, 1943
F.A. (43) 19		20th November, 1943
F.A. (43) 20		20th November, 1943
F.A. (43) 21		29th November, 1943

You will see from these papers that the Deputy First Sea Lord has formed a British co-ordinating committee in London to deal with these projects.

Admiral Sir Percy Noble has formed a similar committee in Washington to act as the liaison between the Board and the British authorities in London and Washington. The membership of this committee is:-

Admiral Sir Percy Noble, Chairman
Commodore McCall, Chief of Staff, B.A.D.
Group Captain Maher, R.A.F.
J.W. Rivett.

It is the opinion of the Deputy First Sea Lord that the smaller Habbakuk, combined with the Tentacle strip is a more practicable proposition than the earlier schemes for a Habbakuk exceeding 2000 ft in length, and he has authorized me to quote his opinion and say that he considers the scheme should receive detailed examination to decide whether or not it is practicable, for, if it be found so, he believes it would be of operational and strategical value.

J.W. Rivett

J.W. Rivett

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Copy No. 9

F.A. (43) 1

Ref. H/3266

27th September, 1943

WAR CABINET

INTER-DEPARTMENTAL SUB-COMMITTEE ON FLOATING AIRFIELDS

COMPOSITION AND TERMS OF REFERENCE

Note by the Secretary

At their 225th Meeting* on 24th September 1943, the Chiefs of Staff Committee:

(a) Agreed that an inter-departmental Sub-Committee under the chairmanship of the Deputy First Sea Lord should be set up and charged with the responsibility for all matters connected with floating airfields.

(b) Took note that the Air Ministry would be represented on the Sub-Committee by two members, each on a Director's level, one with technical and the other with operational qualifications.

(c) Took note that the War Office would be represented on the Sub-Committee by the Director of Transportation.

2. The following will be members of the Sub-Committee:-

Admiral Sir Charles Kennedy-Purvis,
Deputy First Sea Lord.
(Chairman)

Rear-Admiral W.G. Benn,
Director of Navigation,
Admiralty.

Dr. C.F. Goodeve,
Assistant Controller for
Research and Development,
Admiralty.

Captain J.P. Wright, R.N.
Director of Air Warfare and
Flying Training, Admiralty.

Captain S.F. Renwick, R.N.,
Director of Airfields and
Carrier Requirements,
Admiralty.

A Representative of the Director
of Naval Construction,
Admiralty.
(to be notified later)

Major-General D.J. McMullen,
Director of Transportation,
War Office.

* C.O.S. (43) 225th Meeting (O), Minute 6.

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Air Commodore A.R. Wardle,
Director of Operational
Requirements, Air Ministry.

Air Commodore E.M. Lawson,
Director of Operations (Air
Defence), Air Ministry.

Professor J.D. Bernal,
Combined Operations
Headquarters.

Mr. R. Freeman.

Secretary: Commander G.H. Oswald,
Offices of the War
Cabinet.

Terms of Reference - (C.O.S. (43) 572 (O))

3. The Sub-Committee are charged with the responsibility for all matters connected with floating airfields.

4. The Prime Minister has appointed Admiral Sir Percy Noble to be his liaison officer in the United States of America to keep him in touch with experiments and progress over there on floating airfields.

(Signed) G.H. OSWALD.

Offices of the War Cabinet,
S.W. 1.,

27th September, 1943.

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Ref. H/5294

E.A. (43) 17

15th November, 1943

WAR CABINET

INTER-DEPARTMENTAL SUB-COMMITTEE ON FLOATING AIRFIELDS

"TENTACLE"

Note by the Secretary

The annexed report on TENTACLE (Habbakuk IV Steel Pontoon DOCK) describing the flying trials carried out at the U.S. Naval Base, Quonset Point on the 6th November, is circulated for the information of the Sub-Committee and for consideration at the meeting to be held TOMORROW", TUESDAY, 16th NOVEMBER, 1943 at 3.30 p.m.

(Signed) G.H. OSWALD

Offices of the War Cabinet,
S.W. 1.,
15th November, 1943.

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U.S. SECRET
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TO: Deputy First Sea Lord

FROM: J.M. Rivett

SUBJECT: TENTACLE (HABBAKUK IV Steel Pontoon SOCK)

SUBSECTION: Landing, Take-off and other Trials at U.S.N. Base, Quonset Point - November 6th.

REFERENCE: TENT/3

DATE: November 9th, 1943.

After witnessing the trials of the landing and parking strips made of U.S. Naval Steel Pontoons coupled together, on Saturday, November 6th, I have discussed the results of the project with Captain John B. Laycock, U.S.N., Captain C. John, R.N., Fleet Air Arm representative, Commander R.P. Garnett, Group Captain E.A.V. Rogan, R.A.F., and Wing Commander Clyde, R.A.F. The following report is based on my observations, in the light of information supplied by Captain Laycock, and coordinated with the opinions of the other observers. The draft was agreed by Commander Garnett and Wing Commander Clyde.

The landing strip under test was 1800 feet long by 175 feet wide and the parking strip the same length and 50 feet wide. The strips were connected by three main crossways 105 feet wide, one in the center and the other two almost at each end. In each of the two spaces between these were two smaller crossways, each 35 feet wide, giving a total of seven connections.

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The whole flight strip was moored by cables from mooring barges attached amidships on either side. The cables from these join and are attached to a ring which is centred to three 1500 lb. anchors placed at the extremities of an equalateral triangle. This device allows the strip to turn freely and during the trials it was kept head to wind by two pairs of outboard motor pontoons attached at diagonally opposite ends of the strip.

Flying operations were controlled from a specially equipped rescue vessel moored amidships and landings controlled by a Deck Landing Control Officer from a platform aft. This is essential for the use of the strip. Bull horns were also used but not with great success.

The flying tests were carried out by:

16 U.S.N. F6F Hellcats

9 U.S.N. Avenger T.B.F.s (British Tarpon)

9 U.S.N. Dauntless S.B.D.s

giving a total of 34 planes. These landed on in a few seconds under 20 minutes and although some of the pilots were fully trained for carrier flying, the majority was still in course of training and none had landed on the strip before. Despite this, only one pilot had to make a second circuit and in only one case was severe braking required.

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The majority of pilots touched down about 150 to 200 feet from the near end of the strip and pulled up with a comfortable distance to spare. In all cases about 200 feet, in the majority, over 250 feet.

Part of these landings were witnessed from the picket boat as it approached the strip and the balance from the strip itself. From either viewpoint the performance appeared perfectly comfortable.

A slight smell of rubber could be noticed from the landings. In some cases, particularly on first touching down to set the wheels spinning, or if the aircraft were heavily braked, there was smoking from the tyres. These conditions, however, were not considered very much worse than those applying on a concrete runway. It was generally agreed that there would be somewhat heavier than average wear on tyres, and it would be advisable for aircraft to have pneumatic rather than solid-tyred tail wheels. Proposals have been made to grade the change of level between the pontoon plates and the angles but there would not seem to be adequate justification for the considerable expenditure of labour required.

After landing, the planes taxied on to the parking strip where demonstrations of refueling by 1500 gal. motor tender and re-arming, re-bombing and torpedo loading with mechanized equipment were successfully given.

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Demonstrations were also given of fire fighting with heavy mechanized units, trailer units and hand equipment, also in the towing and handling of aircraft with light tractors.

After these tests and after adequate opportunity for discussion, both with the Officer Commanding Flying Operations, Commander R.A. Hation, U.S.N., with the pilots and with other members of the Inspecting Party, the take-off Trial commenced.

Without any difficulty 33 of the 34 aircraft (one was withheld because of engine trouble) were flown off in a few seconds over 13 minutes.

During the trials, conditions had changed from calm sea with a wind at about five knots to slight waves about 1 ft. 6 inches in height and a wind just over 10 knots. The wind had also veered through about 45 degrees but no difficulty seemed to exist in keeping the strip approximately head to wind with the four outboard motors. During the latter part of the take-off when the wind had freshened and veered rather quickly, the strip was between 5 and 10 degrees off wind, but this did not present any difficulty. It was noticeable that even with all the aircraft parked towards one end of the strip and with heavy motor vehicles in the same corner, no apparent change of level took place. In fact, one of the most remarkable features was the absolute steadiness of the strip.

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No movement could be felt either with the landing of aircraft or the passing of motor traffic apart from slight vibration. There was no sign of any whip or any tendency to set up wave motion in the strip.

Prior to these tests, the strip had weathered waves up to about 4 feet in height and a wind with an average velocity of about 45 miles per hour for two or three days. The weather was blowing from the exposed side of the Bay. No ill effect was observed from these conditions.

It was found from observation that waves about 2 feet 6 inches high, caused a movement of plus or minus 4 inches at each end of the strip, but that whilst movement was observed in about the first 100 feet of length and the remainder of the strip appeared absolutely rigid. It is considered that this movement could be overcome by stiffening, but this, whilst it would decrease wear would increase the stresses to be absorbed.

Under the most extreme wave conditions to which it has so far been subjected, the longitudinal articulation joints have been observed to open about three inches and have always returned to normal.

It is proposed now to carry out further experiments erecting fins on the tail of the marking strip to assist keeping it head to wind. Experiments

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are also to be made with fuel barges of 6 by 7 pontoons, landing 90 aircraft in quick succession and finally bombing tests will be made and then the strip towed out to sea for wave tests. These will cover the outstanding matters requiring investigation.

One suggestion made by Air and Naval observers was that the distance between the landing strip and parking strip should be increased so as to avoid an aircraft which went over the inner edge out of control, hitting an aircraft projecting beyond the parking strip. While a small increase could be made here it would reduce the stiffness of the landing strip as a whole and be disadvantageous from a structural viewpoint.

Another suggestion undoubtedly advantageous from the dispersal viewpoint and likely to facilitate operational use is the provision of a second parking strip on the other side. On balance of all counts, however, this would not seem justifiable, particularly from the supply aspect.

It would seem advisable to fit steel mats below the water in the spaces formed between the crossways from the strips so as to catch any aircraft falling over.

The general feeling on the size of the strip was that the present length was adequate for

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all carrier types of aircraft, but that increased length would be required for land base fighter types as was indicated by the R.A.F. tests in England. It was also felt that the width of the landing strip was slightly excessive, while that of the parking strip could reasonably be increased to facilitate the movement of vehicles for re-arming and re-fueling. The only reason given in favor of maintaining present width of landing strip was that it would give pilots, with limited experience, greater confidence during night operations. My opinion is that three rows of pontoons could be taken off the landing strip and two of them added to the parking strip whilst the other formed part of those required for the extra length.

I understand from my discussion with Captain Laycock that the form in which a given number of pontoons can be assembled is flexible, so that after an expedition had set out, if additional length were essential it could be obtained at the expense of a little width on one or both strips.

The present strip uses about 10,000 pontoons. Recently production level has been about 12,000 per month but this has now appreciably increased and expected to reach 20,000 by the end of the current month. To date, the bottleneck on equipment has been on the drop forgings for eye bolts and other connections.

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At the time of these trials all the connections were not completed on the present strip but there was no apparent ill effect and the balance are now in hand. During use there is a tendency for a few pins and sockets to work loose so that a small maintenance crew should always be available and make regular inspection.

In the present strip, the landing section consists of 1 by 6 pontoons with a set of T7s inverted at each end forming a quadrant to reduce wave effects and to eliminate a vertical face for aircraft landing or taking off. The parking strip consists of 1 by 30 pontoons, and while this has the advantage of reducing the wear on the connections which are exposed to movement and crushing, the pontoons are in themselves more rigid and consequently have an increased liability to damage by wave action. Consequently a strip composed wholly of 1 by 6 units would withstand larger waves without major damage because of its increased flexibility.

It seems evident that the hope for an assembly time of between dusk and dawn is impossible of fulfilment because even if sufficient numbers of men could be provided to do the work there would not be sufficient space on the pontoon to enable them to achieve the required result. There is every indication however, that the assembly time will fall, according to varying conditions, at between 48 and 72 hours. To transport a strip having the same total number of pontoons as the present one, it is estimated that 8 ships will be required and a labour force of

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about 2,000 specially trained men.

The procedure is to set the moorings in position first, and this can be done in less than 2½ hours, and then commence sub-assemblies at the stern of each of the ships. These sub-assemblies are then towed to the mooring site and coupled into the final flight strip.

The general opinion, with which I fully concur, was, that assuming similar conditions the strip could be used operationally, as it stood, for carrier types of aircraft, and that with slight and easily made modifications it would be suitable for any type of fighter. To operate larger aircraft it would appear necessary only to increase the size of the strip by allocating more pontoons.

The trials were, in the estimation of all those to whom I have spoken and certainly in my opinion, highly successful.

J.W. Rivett
(J.W. Rivett)

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F.A. (43) 19
20th November, 1943

Copy No. 9...
Ref. H/5296

F.A. (43) 19

20th November, 1943

WAR CABINET

INTER-DEPARTMENTAL SUB-COMMITTEE ON FLOATING AIRFIELDS

"HABBAKUK/TENTACLE"

Note by the Secretary

The annexed report on the "Habbakuk/

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Tentacle" project prepared by Mr. J.W. Rivett for the Deputy First Sea Lord is circulated for the information of the Sub-Committee.

(Signed) G.M. DOUGLAS

Offices of the War Cabinet
S.W.1.,
20th November, 1943.

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Tentacle" project prepared by Mr. J.W. Rivett for the Deputy First Sea Lord is circulated for the information of the Sub-Committee.

(Signed) G.M. OSWALD

Offices of the War Cabinet
S.W.1.,
20th November, 1943.

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NAVY DEPARTMENT
Office of the Chief of Naval Operations
WASHINGTON

Op12L1/hms
(SC)LC/N10-1
Doc. 110559
Serial 077912

1 March 1944.

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SECRET

From: The Chief of Naval Operations.
To: Rear Admiral Ben Moreell, (CEC), U.S. Navy.

Subj: HABBAKUKS, -- Board to Construct Section, Continue Design, and Study Construction and Facilities for.

Ref: (a) C.C.S. 315/11.
(b) CNO serial 0156212 of 8 Oct. 1943 to Rear Admiral Ben Moreell (CEC) U.S. Navy.

1. In view of reference (a), the Board convened by reference (b) is hereby dissolved.

/S/ F. J. Horne

F. J. HORNE
Vice Chief of Naval Operations

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ANNEX

"HABBAKUK/TENTACLE"

Report by Mr. J.W. Rivett

You instructed me to confirm my scheme for carrying an almost completely assembled "TENTACLE" in a "HABBAKUK" Base Ship.

2. I suggested constructing a "HABBAKUK" of about 1200 to 1400 feet length, approximately 220 feet beam which would have a draft of the order of 70 feet to fulfill both the functions of the Depot Ship suggested by the Chief of the Air Staff and also as a carrier for pre-assembled pieces of "TENTACLE" landing strips.

3. This vessel would be very similar in construction to the large concrete floating docks which the Americans have already built, but would have a flat protective deck which would allow U.S. Navy type fighters to operate under all conditions and provide protective cover for the combination on its journey to the operational site, during the laying of the strip, and in the subsequent operations.

4. The "TENTACLE" strips would be stored in racks immediately above the waterline and gates would be provided in the stern so that as the "HABBAKUK" was lowered by the flooding of its buoyancy compartments the strips

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could be floated out from the rock. It appears from the discussions of the Sub-Committee which you formed to consider the scheme, that if four landing and parking strips each 900 feet long were carried these could be used in the following combinations:-

Strips in Use	Aircraft which could operate
2 strips launched and connected	All U.S. Navy types.
3 strips launched and connected	Land based fighters and fighter bombers.
4 strips launched and connected	Medium bombers up to the Mitchell and Mosquito types.

5. It seems to me that the advantages of this scheme are that a "HABBAKUK" of the proposed size could reasonably be powered to steam at 13 or 14 knots, which is in excess of the speed suggested by the Combined Planners. It would carry all the strip facilities, aircraft, personnel, armament, fuel, supplies, etc. in a bomb and torpedo resisting structure which is virtually a floating air raid shelter. During the approach to the operational site, during the strip laying and the subsequent operations the outfit would have its own fighter protection. The use of such a method of transport overcomes the major difficulty of the assembly time of the strip by the earlier proposals under operational conditions and it minimizes the time during which enemy attack can be made against an incomplete strip which could not previously provide its own fighter cover. The

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parent vessel would offer large scale repair and base facilities with the advantages visualised by the Chief of Air Staff and the whole would have a resistance to attack and damage not at present existing in any such scheme.

6. Another use to which such a vessel may be put would be to transport in the dock interior of a number of landing craft which could then be taken close to the site of operations whilst immune from enemy attack. A parent vessel could steam an appreciable distance during the hours of darkness and launch the assault craft before dawn.

7. My proposals do not in any way suggest that the present "HEARTACHE" arrangements for conveying the strip by merchant ships should be varied for the coming Spring as the concrete "HABBAKUK" could not be completed by that time. They do, however, definitely suggest that the combined scheme could be proceeded with at once so that it can be ready in about a year; thus releasing at least ten transports per strip and providing a quicker and more certain method of assault.

(Signed) J.W. RIVETT

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F.A. (43) 1P
23rd November, 1943

Copy No. 9
Ref. H/5279

WAR CABINET

INTER-DEPARTMENTAL SUB-COMMITTEE ON FLOATING AIRFIELDS

"HABBAKUK/TENTACLE"

Note by the Secretary

The annexed report on the "Habbakuk/Tentacle" project advanced by Mr. Rivett at the last meeting (F.A. (43) 4th Meeting, Minute 3), which has been prepared by an ad hoc Sub-Committee presided over by Captain Wright, Director of Air Warfare and Flying Training, Admiralty,

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is circulated for the information of the Sub-Committee.

(Signed) E.H. OSWALD

Offices of the War Cabinet,
C.W.1.,
19th November, 1947.

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ANNEX

HABBAKUK/TENTACLE

Report of Sub-Committee of the Inter-Departmental Sub-Committee on Floating Airfields

A meeting has been held by Admiralty and Air Ministry representatives with Professor Bernal and Mr. Rivett to consider the operational possibilities of the combined Habbakuk/Tentacle project. The following report is based on technical information supplied verbally by Mr. J.W. Rivett.

2. We took as the basis for our discussion a Habbakuk of length approximately 1,200', beam approximately 230'. We were informed that a Habbakuk of this size could have a speed of 12-14 knots one year after construction, would draw about 70' and would be able to carry internally a Tentacle of the largest size we were likely to require. We also discussed the operational possibilities of considerably larger Habbakuks.

3. We are of the opinion that a draught of 70' should not preclude the use of this Habbakuk in the Eastern theatre of war but it may be necessary to tow the Tentacle a few miles after disembarkation, in order to reach suitably sheltered water. We were agreed that, if all the claims made for this combination can be substantiated, the Habbakuk/Tentacle has considerable strategic and tactical possibilities. We visualised its chief use as [illegible]

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Combined Operations, and not as a staging point or advance base for strategical Air Forces.

4. A comparison between this project and the equivalent facilities in aircraft carriers or advanced shore bases required to achieve the same object is desirable and is being made for subsequent report.

Use of the Habbakuk itself

5. It was agreed that in order to avoid complications of assisted take-off gear and arresting gear on the Habbakuk the fighters to be used operationally thereon would best be U.S. Naval types. These could be flown on and off at full fighter loads without arresting gear, etc. and there would be adequate width for parks at the sides clear of the landing strip.

6. It would also be practicable to fly off shore-based types of fighters, fighter bombers and certain light bombers from the deck at light loads.

7. The Habbakuk can be used as a Depot ship for the aircraft which will fly operationally from the Tentacle. The Tentacle aircraft can either be flown off light, or can be ferried across on aircraft lighters. The aircraft lighters could be carried in the Habbakuk, the aircraft being loaded on to them through side ports.

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8. The Habbakuk should have full Radar and Communication facilities for the direction of its own fighters and would be able to give continuous fighter protection to itself and the Tentacle, except possibly during its period of semi-immobilisation while the Tentacle is being disembarked. It would seem wise to provide additional fighter protection from aircraft carriers during the critical period while the Tentacle is being disembarked, set up and towed to its final location.

Size of Tentacle

9. We were informed that the type of Tentacle on which trials have been done would not support a heavy bomber, but that it might be practicable to strengthen the deck sufficiently to allow it to do so. We have not considered the case of heavy bombers as they are not the first requirement for the type of operation visualised, and as we think it wise to plan and construct the Tentacle on the lines which have already been proposed.

10. The lengths of Tentacle which we consider necessary for the various classes of aircraft are as follows:-

(i) American Naval fighters - 1,800 feet

(ii) Other single-engined Fighters and Fighter Bombers (except Thunderbolt) - 2,700 feet

(iii) Mosquitoes and Thunderbolts - 3,600 feet

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We were informed that the most convenient lengths in which to make up the Tentacle would be 900 - 1,000 feet. As 900 feet is a common denominator of all the above lengths we suggest that this should be chosen as the standard unit.

Larger Habbakuk

11. We considered the employment of Habbakuks sufficiently large to operate shore-based fighters without arresting gear, etc. A deck considerably longer would be required, and we were advised that this larger Habbakuk would be likely to have a speed of not more than 7 knots. This low speed would be a severe handicap in operating over the long distances necessary in the Eastern theatre. We therefore recommend that the Habbakuk for this combined scheme should be not larger than is necessary to operate American Naval fighters without arresting gear, etc., and carry the largest Tentacle which is required.

Anti-Aircraft Gun Defence.

12. We were agreed that it is desirable that the Habbakuk should carry its own A/A gun defence. The provision of guns and control equipment will, however, increase the amount of fitting out work, and will complicate to some extent the design and structure. We recommend that some A/A. gun defence should be fitted to the Habbakuk, but we are not in a position to propose details.

13. The Tentacle will also require its own A/A defences, which it is suggested should take the form of floating batteries transported either in the Habbakuk itself or some other accompanying vessel.

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Summary of Recommendations

14. The following is a summary of our conclusions and recommendations:-

(i) That the combined Habbakuk/Tentacle project has considerable possibilities and meets the operational requirements visualised. The comparison mentioned in paragraph 4 above has not yet been made, however.

(ii) That the Habbakuk part shall be only sufficiently large to operate American Naval type of fighters without arresting gear, etc, and to carry the Tentacle.

(iii) That the Tentacle shall be made up in units of 900 feet in length and that we should not for the present consider operating aircraft from it larger than the Mosquito. On this assumption the maximum length required would be 3,600 feet and the pontoon type structure tried out in the United States would appear to be satisfactory.

(iv) That the Habbakuk can in certain circumstances act as a Depot ship for the aircraft operating from the Tentacle, which can either fly off light or be ferried across. Whether or not the Habbakuk could act as a Depot and Accommodation ship in all respects will depend on how close the Habbakuk could be

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kept to the Tentacle.

(v) The Habbakuk will require to be fitted with Radar and Communications for fighter direction and should carry some Anti-Aircraft gun protection. The Tentacle will also require gun defences and probably also facilities for directing aircraft.

(vi) In view of the slow speed and lack of manoeuvrability of Habbakuks and the fact that so many "eggs are on one basket", a high order of invulnerability to bomb and torpedo damage is essential.

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NAVY DEPARTMENT
BUREAU OF YARDS AND DOCKS
WASHINGTON, D.C.

YD Serial 01620

SECRET

1 January 1944

From: Habbakuk Board.
To: Chief of Naval Operations.

Subj: Habbakuks - Board to Construct Section, Continue Design and Study Construction and Facilities for - Monthly Report No. 3.

Ref: (a) VCNO ltr. Op-12A/fhg, (SC)LC/N10-1, Serial 0156212 of 8 October 1943.

1. As directed by reference (a) there is forwarded herewith in quadruplicate for transmittal to the Combined Chiefs of Staff Monthly Report No. 3 covering the progress of the Board to 1 January 1944, and file copy thereof for the convening authority.

B. Moreell
Chairman

Encl.
1.(HW) Monthly Report No. 3
(5 copies)

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MINUTES, MEETING NO. 4, HABBAKUK BOARD

31 December 1943

Meeting No. 4 of the Habbakuk Board was held 31 December 1943 at 1000 in Room 3601 at the Navy Building.

Present:

Capt. W. H. Smith (CEC) USN	Deputy and Secretary
Rear Admiral DeWitt C. Ramsey, USN	Member
Capt. C. M. Bolster, USN	Deputy
Rear Admiral Cochrane, USN	Member
Rear Admiral Charles L. Brand, USN	Deputy
Major W. M. Burgoyne, USAAF	Deputy
Commodore H.W.U. McCall, R.N.	Member
Group Capt. J. W. F. Merer, RAF	Deputy
Mr. J. W. Rivett	Member
Group Capt. M. M. Hendrick, R.C.A.F.	
Commander W.B.L. Holms, RCN	

In the absence of the chairman, Rear Admiral Ben Moreell, Rear Admiral DeWitt C. Ramsey presided at the meeting.

Before reading the draft of the proposed monthly report, Capt. Smith mentioned that the Chairman desired it to particularly state what the Board

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was to do, pending the receipt of additional directives.

Admiral Cochrane's opinion was shared by the majority - that the Board, not having the essential information on operational requirements and characteristics, was confronted with an almost impossible situation.

At Admiral Ramsey's request, Mr. Rivett reviewed the principles of Habbakuk III and said that the British Planners now consider this concrete Habbakuk III the most satisfactory proposal.

Capt. Smith, said the Habbakuk is to have two purposes (1) Use in lieu of fields in the Burma Theatre and in the Southwest Pacific and (2) staging places across the Pacific.

Mr. Rivett termed the second phase an alternative use, to be used in combination with assaults.

The acting chairman read Group Capt. Merer's drafted memo on strategical considerations in the employment of Habbakuk III/Tentacle.

Mainly because speed and mobility, necessary when under day and night air attack, are missing in Habbakuk, it was Admiral Ramsey's opinion that there could be no profitable use of such a structure in the Central Pacific.

Mr. Rivett read a note by the Director of Naval Air Warfare, Admiralty on a comparison between the operational capabilities of small Habbakuk and

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Aircraft Carriers. He feels that Habbakuk/Tentacle can operate land based planes against the mainland and they can be landed on the strip with no arresting gear.

Commodore McCall said the speed of an ordinary assault convoy must be considered because the Habbakuk is to travel with the convoy and at night prepare to operate in the morning. This will have to be done in sheltered water.

When Capt. Bolster asked how Sock and Hangars were to be combined in the structure, Capt. Smith produced rough sketches.

It was moved and passed that the monthly report state it was understood that the British Joint Staff Mission has received instructions from London to put to the Combined Chiefs of Staff, the study of Habbakuk III and Tentacle. The Board agreed that until this was studied and proper directives received, it could do nothing constructive.

The meeting adjourned at 1115 to await the receipt of definite directives.

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F.A. (43) 5th Meeting

WAR CABINET

INTER-DEPARTMENTAL SUB-COMMITTEE ON FLOATING AIRFIELDS

MINUTES of Meeting held on MONDAY, 22nd NOVEMBER, 1943, at 3.15 p.m.

PRESENT:

Admiral Sir Charles Kennedy-Purvis,
Deputy First Sea Lord.
(Chairman)

Rear Admiral W.G. Benn,
Director of Navigation.

Dr. C.F. Goodeve,
Assistant Controller for

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Admiralty.

Research and Development,
Admiralty

Captain G.F. Renwick, R.N.,
Director of Airfields and
Carrier Requirements,
Admiralty.

Captain J.P. Wright, R.N.,
Director of Air Warfare
and Flying Training,
Admiralty.

Mr. W.G. Sanders,
Deputy Director of Naval
Construction, Admiralty

Mr. H.J. Nowlan,
Assistant Civil Engineer-
in-Chief, Admiralty.

Major-General D.J. McMullen,
Director of Transportation,
War Office.

Air Commodore A.R. Wardle,
Director of Operational
Requirements, Air Ministry.

Professor J.D. Bernal,
Combined Operations
Headquarters.

THE FOLLOWING WERE ALSO PRESENT

Captain G.B. Sayer, R.N.
Deputy Director of Training
and Staff Duties, Admiralty

Sir Stanley V. Goodall,
Assistant Controller
(Warship Production),
Admiralty. (For Item 2).

Mr. J.W. Rivett
Habbakuk Board.

Mr. F.W. Mottershead,
Head of Military Branch I
Admiralty

Commander G.H. Oswald.....Secretary

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1. "HABBAKUK/TENTACLE" PROJECT

THE SUB-COMMITTEE had before them -

(i) A note by the Secretary covering a report by an ad hoc Sub-Committee (F.A.(43) 18).

(ii) A note by the Secretary covering a memorandum by Mr. J.C. Rivett (F.A. (43) 19).

THE CHAIRMAN said that in his opinion the idea of "Habbakuk" carrying its own "Tentacle" was a good one and had considerable possibilities if construction of such a vessel proved feasible.

MR. SANDERS said that he had only had time for the very briefest examination, but he must stress that the project bristled with difficulties.

DR. GODDEVE queried the expression "we are informed that" which occurred in several places in the ad hoc Committee's report.

IT WAS AGREED: -

that the report should be amended by the addition of a sentence to make it clear that all technical information had been supplied verbally by Mr. Rivett [illegible]

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Habbakuk Board.

DR. GOODEVE felt that it was important that a comparison should be drawn between this project and the equivalent number of aircraft carriers required to achieve the same operational object. He said that it was also important to point out that due to the very slow speed of the "Habbakuk" it would be very vulnerable to attack from the air and from under the water, and that consequently it should have a very high degree of invulnerability. A further point was that any such scheme entailed having a large number of "eggs in one basket".

CAPTAIN RENWICK felt that a truer picture would be presented by comparing the project with the equivalent shore facilities required. The "Habbakuk/Tentacle" was designed for some intermediate stage of any operation and did not do away with shore base requirements nor with aircraft carrier requirements.

CAPTAIN WRIGHT thought that on the basis of a particular operation a useful comparison could be drawn between the "Habbakuk/Tentacle" and an equivalent number of aircraft carriers. He undertook to make this comparison for the information of the Sub-Committee.

THE CHAIRMAN said that in considering the operational possibilities of this project, both the Pacific and the South-East Asia Command must be considered. It was quite possible that the project might be found technically

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impossible but that was for the Habbakuk Board to determine. His view was that, if the project should prove feasible, it would have very great operational possibilities and must be examined from that aspect.

PROFESSOR BERNAL said that the question of small islands which were highly mountainous or too small for the establishment of air bases had to be considered and in such cases a project of this nature might be of considerable value.

THE SUB-COMMITTEE went through the report of the ad hoc Committee (F.A. (43) 18, Annex) paragraph by paragraph and a number of minor amendments were agreed upon.

AIR COMMODORE VASSE undertook to keep Chief of the Air Staff informed of the project and any subsequent developments.

THE SUB-COMMITTEE:-

Instructed the Secretary to circulate the amended report for the information of the Sub-Committee, and to arrange for its despatch to the Habbakuk Board.

2. HANDLING OF "HABBAKUK" MATTERS IN THE UNITED KINGDOM

THE SUB-COMMITTEE had before them a note by

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the Secretary covering a memorandum by Mr. [illegible] proposing the setting up of two co-ordinating Committees for "Habbakuk" affairs. (F.A. (43) 23).

THE CHAIRMAN sought the views of the Sub-Committee on this matter and said that there appeared to be three possible courses of action:-

(i) A co-ordinating Committee consisting of Admiralty Staff Departments only.

(ii) A co-ordinating Committee consisting of Staff Departments and Representatives of the Controller Departments.

(iii) That the Admiralty should have no share in "Habbakuk" matters at all.

He made it clear that in view of his personal responsibility to the Prime Minister he desired to have the help of a small Committee for handling of "Habbakuk" and "Tentacle" affairs. The present Floating Airfields Sub-Committee would continue to function at least until a final report on the "Tentacle" project had been made to the Prime Minister, but the smaller co-ordinating Committee would be required to function for a considerable period thereafter.

DR. [illegible] was strongly of the opinion that the Admiralty should have nothing whatsoever to do with "Habbakuk" affairs.

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MR. MOTTERSHEAD pointed out that it had been decided at the Quadrant Conference that all technical responsibility was vested in the Combined Anglo-American-Canadian Habbakuk Board, and that therefore the Admiralty had no responsibility for the technical aspect of any "Habbakuk" affairs.

After considerable discussion IT WAS DECIDED -

that a small co-ordinating Committee for handling "Habbakuk/Tentacle" affairs in the United Kingdom should be set up composed as follows:-

Deputy First Sea Lord (Chairman)

D.D.M.C., Admiralty

D.T.S.D., Admiralty

D.A.W.T., Admiralty

D.A.T., Air Ministry.

Captain Buzzard, Joint Planning Staff.

Professor Bernal

Commander Oswald - (Secretary) Offices of the War Cabinet.

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Offices of the War Cabinet.,
S.W.1.,

24th November, 1944.

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Copy No. 9

F.A. (43) 20
20th November, 1943

Ref. H/5287

WAR CABINET

INTER-DEPARTMENTAL SUB-COMMITTEE ON MOORING AIRFIELDS

HANDLING OF "HABBAKUK" AFFAIRS IN THE UNITED KINGDOM

Note by the Secretary

The following summary of proposals which have been made by Mr. J.W. Rivett of the Anglo-American-Canadian "Habbakuk" Board for co-ordination of the Board's work with Service Departments in London is circulated for the information of the Sub-Committee, with a view to discussion at the meeting to be held on Monday, 22nd November, 1943.

2. It is suggested that two small representative co-ordinating Committees be formed, one in London and the

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other in Washington. The function of the Washington Committee would be to co-ordinate and forward all information on "Habbakuk", "Tentacle", or any other form of floating airfield as well as all the papers produced by the Combined "Habbakuk" Board. The Washington Committee would deal direct with the London Committee which would transmit the information to the Service authorities concerned. Besides transmitting incoming information the London Committee would be in a position to obtain through its members answers to any questions raised by the Washington Committee or the Combined Board. It is suggested that by limiting the membership the Committees would be small enough to act quickly and could be assembled if necessary at short notice, and would be able to co-opt anyone whose opinion was required.

2. Suggested composition of the Committee

(a) London Committee:

Deputy First Sea Lord (Chairman)
D.T.S.D. Admiralty
D.A.W.T. Admiralty
D.A.I. Air Ministry
Captain Buzzard, Joint Planning Staff
Professor Bernal, Combined Operations
A Secretary.

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(b) Washington Co[illegible]:

B.A.D. (Chairman)
Chief of Staff
Mr. J.W. Rivett (who would act as Secretary)

4. The Washington Committee would arrange that six copies of all relevant minutes and other documents of interest to the London Co[illegible] should be transmitted by sea at regular intervals. They would also arrange transmission of urgent matter by air mail if required.

5. It is suggested that once the machinery is established a monthly meeting of these co-ordinating Committees should normally suffice.

6. Mr. Rivett considers that an arrangement on these lines will meet with the approval of Admiral Noble and the Habbakuk Board, whose Chairman is Admiral Morreal.

(Signed) G.H. OSWALD

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Office of the M.A. Cabinet,
D.M.I.

20th NOVEMBER, 1943.

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Ref. H/5260

F.A. (43) 21

29th November, 1943

WAR CABINET

INTER-DEPARTMENTAL SUB-COMMITTEE ON FLOATING AIRFIELDS

COMPARISON BETWEEN OPERATIONAL CAPABILITIES OF SMALL FLOATATK AND AIRCRAFT CARRIERS

Note by the Secretary

The attached note by the Director of Air Warfare and Flying Training and the Director of Airfields and

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Carrier Requirements is circulated for the information of the Sub-Committee.

(Signed) B.H. OSWALD

Offices of the War Cabinet,
S.W.1.,
29th November, 1943.

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ANNEX

COMPARISON BETWEEN OPERATIONAL CAPABILITIES OF SMALL HABBAKUK AND AIRCRAFT CARRIERS

Note by D.A.W.T. and D.A.C.R.

This Note attempts to make the comparison referred to in Paragraph 4 of the Report of the Sub-Committee on the Habbakuk/Tentacle project (F.A.(43) 18 dated 23rd November, 1943).

2. The best and possibly the only method of assessing quantitatively the relative capabilities of a small Habbakuk and Fleet Carriers appears to be to assume that both operate only fighters of the latest type. We have made a comparison on this basis, taking as the standard aircraft the Corsair. This aircraft is capable of being used as a long range fighter or as a short range fighter bomber.

3. We can think of no basis for making a quantitative comparison between a Habbakuk/Tentacle and "Aircraft Carriers cum landing strips" ashore.

Layout of Habbakuk

4. We have assumed that a landing strip 120 feet

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wide would be left on the deck. This leaves a parking strip 100 feet wide, part of which must be left clear for taxying spread aircraft. The lifts must also be kept clear of parked aircraft.

5. We have assumed that it is practicable to provide a hangar 120 feet wide by 500 feet in length. The height of hangar should be not less than 17 feet 6 inches clear. At the end of the hangars would be 30,000 lb. lifts, size 50 feet x 70 feet; extending fore and aft of the lifts would be extensions 60 feet long x 120 feet wide, which in the later stages of operations would be used for aircraft under repair. This size of hangar is our own estimate, and is based on the assumption that about the same proportion of space can be allowed to hangars as is the case in large Fleet Carriers. We have estimated that the complement for full operations will not be less than 5,000. It will not be practicable to pack this very large hangar as tightly as the smaller hangars of Fleet Carriers. We have made separate estimates for Habbakuks with one or two Hangars.

Number of Aircraft which can be operated

6. The following is the number of Corsair aircraft which it is estimated can be operated from the Habbakuk:-

As a Deck Park	-	110
In the Hangar	-	65
In, and around the two extensions	-	20

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The total is about 200, if there is only one hangar floor, or between 250 and 300 if two hangars can be provided.

Stowages in Fleet Carriers

7. The following are stowages (Hangars plus Deck Park) in various Classes of Fleet Carriers:-

INDEFATIGABLE Class	-	60 Hellcats, (as Corsairs are too high when folded)
COLOSSUS Class	-	53
ARK ROYAL Class American-ESSEX Class)	-	90 - 100

Conclusions

8. On the basis of the total number of fighter aircraft which it is estimated can be operated, but without taking any time factors into consideration, the small Habbakuk can be compared as follows:-

(i) With one hangar it equals 4 British COLOSSUS Class Light Fleet Carriers, or 2 big Fleet Carriers (British ARK ROYAL Class, or United States ESSEX Class).

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(ii) If two hangars can be fitted, one Habbakuk equals 5 or 6 British COLOSSUS Class Light Fleets, or 3 large Fleet Carriers, British or United States.

9. It must be emphasised that this assessment takes no account of the merits of the two on account of production time and costs, relative vulnerability, speed, ability to ferry or operate other types of aircraft, ability to act as a depot ship, or any other factors which must be taken into account in making a fair comparison.

(Signed) J.F. WRIGHT

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BRITISH JOINT STAFF MISSION

OFFICERS OF THE COMBINED CHIEFS OF STAFF

WASHINGTON

MOST SECRET

TO: British Co-ordinating Committee in Washington.

FROM: Group Captain J.W.F. Merer, R.A.F.

SUBJECT: Habbakuk III/Tentacle

SUBSECTION: Strategical Considerations in its Employment.

REFERENCE: H/5333

DATE: 31st December, 1943.

1. Assumption

The characteristics of the Habbakuk III/Tentacle are assumed to be:

HABBAKUK III - Length of flight deck - 1200/1400 ft.
Beam " " " - 250 ft. (approx.)
Speed - 12 to 14 knots.

TENTACLE - Maximum length - 3600 ft.(4 sections

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(U.S. SCCE) 900 ft. each)
- Width of flight strip - 144 ft.
- Width of parking strip 65 ft.

The Habbakuk would be capable of flying off land type fighters and possibly lightly loaded Mosquitos but would require arrester gear for landings. The Tentacle could operate land based fighters, fighter bombers, and aircraft of the characteristics similar to the Mosquitos.

2. Theatre of Operation

For the following reasons the Habbakuk/Tentacle will be employed in the Pacific theatre only:

(i) The highly developed air defenses and warning system on the European coast;

(ii) The completion of the Habbakuk is unlikely within a year by which time the full scale amphibious assault on the North European coast will have been executed.

Its suitability to the Pacific theatre is studied in detail later.

3. Employment of Tentacle without Habbakuk

For the following reasons it does not appear that the Tentacle alone without the Habbakuk III provides any advantages over existing facilities and

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equipment except in very favourable circumstances:

(i) Its strategic immobility

(ii) The number of ships required to transport it (approx. 10)

(iii) The delay in assembling and dismantling it on an operational site.

(iv) Its vulnerability to air attack because it has not organic A/A defenses as has the Habbakuk.

(v) Its comparative fragility in a heavy sea.

4. Employment of Habbakuk III/Tentacle

The transport of the Tentacle in assembled strips within the Habbakuk will give it the mobility of a normal assault convoy. Moreover, during passage, carrier types of aircraft can be operated from the Habbakuk for convoy protection. Alternatively, it can be used for offensive operations, except with the Fleet, in the same role as a normal carrier.

5. The combination of the Habbakuk and Tentacle should also give great flexibility to our strategical plans. The choice of the actual area of our amphibious assaults is largely decided by our ability to provide air support from aircraft carriers and/or to capture an enemy air field at a very early stage. In the case of an assault beyond fighter range from the enemy's nearest airfield, an aircraft carrier can probably op-

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erate with [illegible] immunity with its own fighter protection. Presuming that an air field is available after capture, or that the terrain permits the speedy construction of one, the need for the Habbakuk/Tentacle is minimized. Should, however, an air field not be readily available, or the delay in construction long, the Habbakuk/Tentacle would be of high value to us.

6. For an assault on the mainland, or in circumstances where the enemy can reinforce fairly readily his air force in the area of operations, the use of the Habbakuk and Tentacle may widen the choice of the actual point of our attack since the early capture of an airfield, except as a defensive measure, may not be vital. It may well be possible to locate the Tentacle in a sheltered area at some distance from, but within fighter range, of the assault area, especially if measure of surprise is obtainable. Its employment in these circumstances, in combination with normal aircraft carriers may possibly reduce the risk to the latter, while increasing the effectiveness of the air support for the assault.

7. It should be borne in mind that the Habbakuk/Tentacle project is not intended to supercede or compete with either aircraft carriers or airfields. In fact, it is intended to be supplementary to both, as it is probable that it can be produced in parallel with carriers without unduly competing with their

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priorities. The main intention is that it should help in the provision of the maximum amount of fighter cover on 'D' day and should also bridge the gap between that time when aircraft carriers can no longer provide all the necessary fighter cover and assault plans, and the day when the first landing fields are completed ashore. Moreover, it makes possible the use of land based fighters and fighter bombers at an earlier stage in the operation.

B. Alternative Use

Another use which it may be worthy of examination, is for the Habbakuk/Tentacle combination to provide staging points between main bases and operational areas, if the Tentacle can be anchored in reasonably sheltered areas when the Habbakuk would provide such fighter protection as it would require and refuelling and re-arming facilities for the planes on their way to the assault area.

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NAVY DEPARTMENT
BUREAU OF YARDS AND DOCKS
WASHINGTON, D. C.

SECRET

2 December 1943.

From: Chairman, Habbakuk Board.
To: Brigadier General Glen C. Jamison, USAAF.

Subject: Habbakuks - Board to Construct Section, Continue Design, and Study Construction and Facilities for.

1. Forwarded herewith are Enclosures (1) and (2) for your information and retention.

W. H. Smith,
Secretary.

Encl. 1. Monthly Report No. 2, Habbakuk Board.
2. Minutes Meeting No. 3, Habbakuk Board.

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MINUTES OF MEETING NO. 3 - HABU HABU BOARD

SECRET

Meeting No. 3 of the subject Board was held 1 December 1943 at 1000 in Room 3301, Navy Building:

Present:

Rear Adm. Ben Moreell (CEC) USN	Chairman
Capt. W. H. Smith (CEC) USN	Deputy & Secretary
Rear Adm. Dewitt C. Ramsey, USN	Member
Capt. C. M. Bolster, USN	Deputy
Const. Capt. A. N. Harrison, RCN	Member
Group Capt. A. L. James, RCAF	Deputy
Group Capt. F. R. West, RCAF	Deputy
Rear Adm. C. L. Brand, USN	Deputy
Major W. M. Burgoyne, USAAF	Deputy

Group Captain James requested that Group Captain F. R. West, RCAF, be designated to replace him as deputy for Air Vice Marshal Walsh.

The Chairman read the proposed Monthly Report No. 2. Because there have been no replies to the Board's requests for additional directives, the Chairman said there was nothing the Board could do further except to discuss tentative hypotheses, which procedure he considered unsatisfactory.

Admiral Moreell noted that the drafted report did not mention that the "Sock Project" at Davisville will be towed in rough water December 2. It has been successfully utilized for flying and it now remains to determine in how rough water it can still operate. Bomb tests will then be made.

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Also, at the Chairman's suggestion "Method of Financing", referring to Lend-Lease appropriations for Habbakuk construction was added to the list of additional directives requested by the Board. Capt. Smith read part of the Chairman's 23 October 1943 letter to the Chief of Naval Operations which recommended Lend-Lease financing. A copy of this letter was included in the Monthly Report No. 1 to the Combined Chiefs of Staff.

Group Capt. James' comment was approved that the report should specifically state that the 23 October Board letters went first to the Chief of Naval Operations and were then transmitted to the Joint Chiefs of Staff.

Capt. Smith verified the statement that the letters had been forwarded by the Commander-in-Chief to the Joint Chiefs of Staff, with recommendation that they be referred to the Combined Chiefs of Staff, by referring to a copy of the transmitting memorandum.

With no further comments on the proposed report, the Chairman assumed it approved and ready to be sent to the Vice Chief of Naval Operations for transmittal.

Capt. Smith asked if anyone knew whether or not Commodore McCall had received Staff requirements from London. Admiral Morsell had received no word from the Commodore. His opinion was that the Board would be given some positive statement at the close of the current conference.

The meeting was adjourned at 1015.

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YD Serial 01545

NAVY DEPARTMENT
BUREAU OF YARDS AND DOCKS
WASHINGTON, D.C.

SECRET

1 December 1943.

From: Habbakuk Board.
To: Chief of Naval Operations.

Subject: Habbakuks - Board to Construct Section, Continue Design and Study Construction and Facilities for - Monthly Report No. 2.

Reference: VCNO ltr. Op-12A/fhg, (SC)LC/N10-1, Serial 0156212 of 8 October 1943.

1. As directed by reference (a) there is forwarded herewith in quadruplicate for transmittal to the Combined Chiefs of Staff Monthly Report No. 2, covering the progress of the Habbakuk Board to 1 December 1943, and file copy thereof for the convening authority.

B. Moreell,
Chairman.

Encl. 1. Monthly Report No. 2.
(5 copies)

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BOARD TO CONSTRUCT SECTION, CONTINUE DESIGN AND STUDY CONSTRUCTION AND FACILITIES FOR HABBAKUK II

MONTHLY REPORT NO. 2
1 DECEMBER 1943

SECRET

1. Meeting No. 2 of the subject Board was held in the Navy Building at 1000 on 29 October 1943. The monthly report was read and approved.

2. Following a general discussion of the probable military characteristics and objectives of Habbakuk II, Commodore McCall presented informally a London staff appreciation on Habbakuks which indicated the desirability of proceeding with a number of smaller Habbakuk III's in lieu of a smaller number of Habbakuk II's. It was agreed that such a program would completely change the Board's directives. To accelerate progress on the Habbakuk project, a proposal was approved that Commodore McCall consult the Vice Chief of Naval Operations and request staff requirements from London.

3. The project for the experimental construction of a pontoon flight strip nearing completion at Davisville, R.I., and the differences in strategic concept of this strip and Habbakuks were discussed.

4. Arrangements for financing the Habbakuk program, if undertaken, were also discussed.

5. No further action was taken by the Board during the month, pending re-

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ceipt of instructions requested by the two letters dated 23 October from the Chairman of the Habbakuk Board to the Chief of Naval Operations, transmitted to the Joint Chiefs of Staff by memorandum from the Commander-in-Chief 29 October. Additional directives have been requested on:

(a) time schedule for completion of work of the Board;

(b) relative priority of project as compared to the current ship and shore construction program;

(c) the scope of functions of the Board;

(d) the specific military objectives and military characteristics of Habbakuk II;

(e) method of financing.

6. Report on landing and take-off trials by the Royal Air Force (designation Tentacle) was presented by the British representatives and distributed to the Board members for information.

7. Report was received from the Superintending Civil Engineer, Area VII, reporting on the survey of possible sites for the construction of Habbakuk II and recommending three specific alternative construction sites in the

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Puget Sound area for each of the pykrete and concrete structures.

8. No meetings of committees of the Board were held during the month, pending additional directives.

9. Monthly Report No. 2 was approved by the Board at its meeting on 1 December 1943.

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YD Serial 01463

NAVY DEPARTMENT
BUREAU OF YARDS AND DOCKS
WASHINGTON, D. C.

SECRET

11 November 1943.

From: Chairman, Habbakuk Board.
To: Brigadier General Glen C. Jamison, USAAF.

Subject: Habbakuk Board - Change of Meeting.

1. Meeting No. 3 of the subject Board, originally scheduled for 26 November 1943, will be held 1 December 1943 at 1000 in Room 3601, Navy Building.

W. H. Smith,
Secretary

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BRITISH ADMIRALTY DELEGATION

SEVENTEENTH STREET AND CONSTITUTION AVENUE

WASHINGTON, D. C.

U.S. SECRET
BR. MOST SECRET

TO: Rear Admiral B. Moreell, CEC, USN.
Chairman of the Habbakuk Board.

FROM: J.W. Rivett

SUBJECT: HABBAKUK

SUBSECTION: HABBAKUK II
(1) & (2) Report on British Advisors' Visits to Canada.
(3) Notes on Captain W.H. Smith's Proposals for Pykrete Production.
(4) Notes on U.S. Proposal for Concrete Construction.

REFERENCE: H/5235

DATE: November 1st, 1943.

Attached are copies of four memoranda which have been prepared by British Technical and Scientific advisors:

(1) Dr. M.F. Perutz's report on his visit to Canada - (H/5213)

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(2) Mr. E.S. Green's report on his visit to Canada - (H/5171)

(3) Dr. Perutz's and Mr. Green's notes on Captain W.H. Smith's Proposals on Pykrete Production (H/5215)

(4) Mr. W.R. Wright's notes on U.S. Proposal for Concrete Construction - (H/5210).

Sketches showing the suggested modification to the concrete construction which are mentioned in Mr. Wright's notes and based on Tank Trials which took place at the National Physical Laboratory in England, are in preparation and expected to be available within the next few days.

The motion picture film of the Tank Trials for Habbakuk Models I, II and III are expected to be available shortly should you or any members of the Board care to see them.

Encs. 4

(J.W. Rivett)

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U.S. SECRET
BR. MOST SECRET

TO: Mr. J.W. Rivett.

FROM: Dr. M.F. Perutz

SUBJECT: Habbakuk

SUBSECTION: Report on Visit to Canada

REFERENCE: H/5213

DATE: October 26th, 1943.

(1) It was decided in agreement with C.O.S. that I should visit Canada so as to acquaint myself with the research on pykrete that had been carried out there under the auspices of the National Research Council. I left Washington on the 9th of October and returned on the 19th; I spent three days at Ottawa, one day at Saskatoon, Saskatchewan, and the other six days travelling. Until the time when I left Ottawa I travelled together with Mr. Green.

(2) At Ottawa, Mr. Green and I had discussions with Dean MacKenzie, Dr. W.H. Cook, Mr. T.A. Steeves

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and Dr. C.D. Niven, all members of the Laboratory of the National Research Council. Dean MacKenzie gave us a picture of the research work which had been carried out in Canada; he explained that nearly all pykrete research had been done at Harbour Cold Storage in Montreal under the supervision of G.M. Williams, Professor of Engineering at the University of Saskatchewan, Saskatoon. Professor Williams had returned to Saskatoon at the beginning of September. At that time Dean MacKenzie had told Professor Bernal that he would keep the experimental room at Montreal in being for one more month and that the personnel and equipment would be disbanded at the end of that period unless a demand for further research arose in the meantime. Since no such request had been received the experimental room had been dismantled. The Dean informed me that the only person with full working knowledge of the Pykrete research is Professor Williams himself. It was agreed accordingly

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that my best plan would be to see Professor Williams at Saskatoon.

(3) The discussion with Dr. Cook and Mr. Steeves centred mainly on the refrigeration aspect of Habbakuk. Dr. Steeves had, however, prepared some samples of Pykrete, both in the wet and frozen form which were demonstrated to us. This demonstration was most interesting as it helped to clear up the discrepancy between the optimum pulp concentrations used in Canada and England respectively. We had always worked with 14% pulp because lower concentrations gave rise to ice-layers being formed between successive layers of Pykrete. The Canadian workers, on the other hand, used 4, 6 and 8 percent mixtures. It was immediately apparent from the wet Pykrete shown to us that the Canadian pulp fibre had much

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better filling properties than ours. The consistency of their 10% Pykrete in the molten state corresponded to our 14%, while their 14% mixture was so dry and crumbly that it was difficult to roll it into a homogeneous layer. I cannot offer any satisfactory explanation for this difference in behavior of Canadian spruce pulp as compared to the Scotch pine pulp which we used, but presumably it is due to the different wetting properties of the two fibres.

(4) Dr. Niven is a physicist whose special subject is heat. He gave us a complete account of the construction of the 1,100 ton model on Lake Jasper, for which he was responsible. According to him, one of the more serious difficulties was presented by the intricate system of cooling ducts. Mr. Green mentioned that we had abandoned the idea of using metal ducts in Habbakuk, but intend to make the ducts of Pykrete lined with some impermeable material designed to prevent evaporation of ice from the ducts. Dr. Niven gave us a variety of

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impreginated papers and cardboards, together with accurate information on their permeability to water vapour. Some of the papers seemed very satisfactory indeed. They could be procured from Messrs. Currie Products, Ltd., Montreal and Alexander Murray, Ltd., Montreal. I also discussed with Dr. Niven the problem of finding a suitable substance for filling the void of Habbakuk, and he suggested a new substance known as diatomite, a highly porous light material of considerable strength which could be mined in large quantities in Western Canada. In the meantime I received another suggestion from him, a copy of which is attached to this report. Finally Dr. Niven pointed out that there is no need to use one substance only for filling the void, but a variety of materials could be used as supplies became available.

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(5) Professor Williams carried out a large variety of mechanical tests with Pykrete during the summer months. A summary of his tests is contained in a preliminary report, a copy of which is attached. The main points emerging from the report and my discussions with him are these:-

(a) Pulp concentration and specific gravity. As mentioned under paragraph three, Professor Williams used lower concentrations than we did. Most of his test pieces were grown in moulds, where excess water was pressed out of the mould during freezing and could be scraped off afterwards, leaving a homogeneous specimen behind. In view of our reports regarding the inhomogeneous nature of 6% Pykrete frozen in layers and the fact that freezing in layers is the only method of Pykrete production practicable on a very large scale, Professor Williams tried to grow some of his test pieces in layer form in a wind tunnel. He reports that 6% Pykrete was just as homogeneous as our 14% material and that so long as spruce pulp

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is used he sees no reason why concentrations higher than, say, 10% should be aimed at. (As will be pointed out below, the mechanical properties of 6% Pykrete, both in the wet and the frozen forms, are not entirely satisfactory).

The specific gravity of Canadian Pykrete is considerably below the English variety; this leads to a substantial gain in buoyancy as shown in the table below. It is seen that by using 10% spruce pulp instead of 14% Scotch pine a gain in buoyancy of nearly 4% is made. This improvement in buoyancy can be obtained without losing any mechanical strength.

TABLE I

Pulp Concentration	Type of Pulp	Specific Gravity	Buoyancy percent

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14%	Scotch Pine	.98	4.6
14%	Can. Spruce	.958	7.2
10.5%	"	.945	8.4
8%	" "	.941	9.0
6%	" "	.940	9.2
4%	" "	.934	10.0

(b) Effect of Pulp concentration on mechanical properties.

Addition of as little as 4% pulp eliminates the tendency of ice to failure under low stresses. Above a concentration of 4% the compressive strength of Pykrete in the direction normal to the freezing surface does not vary with the pulp concentration and always remains of the same order as the corresponding values found by the N.P.L. Compressive strength parallel to the freezing surface, however, is considerably below the maximum value in 4% and 6% pulp. To eliminate this anisotropy it is necessary to raise the pulp concentration to 10%.

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The tensile strength of Pykrete greatly depends on the pulp concentration. At a testing speed of 0.1" per minute and a temperature of 15°F, 4% Pykrete has the tensile strength of 303 lbs. per square inch, 6% Pykrete gives 360 lbs. per square inch and 14% Pykrete give 700 lbs. per square inch. This last figure is comparable to the N.P.L. value of 740 lbs. per square inch obtained under analogous conditions.

Similar trends are shown by the moduli of rupture of bent beams. Values of bond strength of joints and bond strength between Pykrete and wood are comparable with the N.P.L. figures, except that joints made with spruce pulp seemed to show a lesser tendency to fail under abnormally low loads. Bond strength tests between steel and Pykrete gave disappointing results.

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There is not much difference in the rates of creep under compression of 4%, 6% and 8% Pykrete. Moreover Professor Williams' preliminary figures are of the same order as our own, i.e. 1% per annum at stresses under 100 lbs. per square inch. Professor Williams did, however, find indications that creep in his specimens dropped to zero after several weeks. He undertook to send me a confirmation of these results as soon as he has worked out his latest data.

(c) Freezing Times.

Professor Williams measured the rate of freezing of 3/8" Pykrete layers by a technique which was much superior to our own. While we considered a layer frozen when it was solid throughout, Professor Williams embedded thermocouples at the bottom of each layer and measured the time taken for the temperature to drop below the freezing point. He found that layers were apparently solid long before all the latent heat had been removed and that complete freezing thus takes about 50% longer than indicated by the graphs

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in our report.

(d) Professor Williams is preparing a full report on all his tests, but in view of his heavy teaching duties at the University it is unlikely that he will be able to complete this much before the end of the year.

(6) Conclusions.

(a) Pulp concentration. It is obvious from this report that nothing will be gained by using a concentration of spruce pulp higher than 10%. While a concentration of 6% gives a material which is satisfactory in certain respects, such a low concentration can nevertheless not be recommended on the following grounds. Firstly, the 6% pulp loses all coherence in the molten state and its rate of erosion under wave action would be little superior to that of pure ice; 10% pulp on the other hand, forms a coherent mush which cannot easily be washed away. Secondly, the

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production of 6% Pykrete would present new problems: the mixture is too thick to be pumped effectively and not coherent enough to be spread in layers by a rotary filter machine such as the one envisaged in Mr. Thompson's report; the manufacture of this mixture from the usual 1% slush would be a new and untried process, so that it would probably have to be made by re-wetting dried pulp in a beater. Lastly, it must be expected that the reduced tensile strength and anisotropy in compression would result in a reduction of its resistance to explosives.

Since the optimum pulp concentration depends so largely on the grade of pulp that is to be used, an investigation into the types of pulp that would be available in sufficient quantities on the West Coast of the United States is indicated. Professor Williams recommended that we should seek the advice of Dr. Boyd Campbell, Director of the Pulp and Paper Institute of McGill University, Montreal, who is already fully informed on the Habbakuk project.

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(b) Mechanical properties.

Professor Williams' tests, although carried out with a material and a freezing technique different from our own, largely confirm the results obtained in England; at the same time Professor Williams' experiment went further in introducing pulp concentration as an additional variable. While English and Canadian results are consistent, neither of them show any compressive strength approaching the values of 5,000 lbs. per square inch which Dr. Hohenstein obtained in New York. It must be presumed that the very great strength of their materials is due to the longer fibres and superior wetting properties of the chemical pulp which they used as a filler, while the ground wood lap in England and Canada consists to 40% of fine powder and contains mostly fibres under half a millimetre in length. It should be pointed out, however, that chemical pulp is not being produced in quantities sufficiently large

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for the purposes of this project.

(c) Freezing Times.

While Professor Williams' freezing times will necessitate an increase of 50% in the area of the Pykrete factory as estimated by us, it will not introduce any change in the estimates of the power requirements, since the latter are based purely on considerations of the latent heat that is to be removed per unit of time.

(d) Pulvopick and Aeropick

Dr. Mark and Dr. Hohenstein had recommended that their experiments on pulvopick and aeropick be taken up at the Montreal laboratory in view of the superior facilities available there. Nothing can be done about this for the time being, since the Canadian Pykrete research has been discontinued and the experimental cold room closed down. Any request for such work would have to come through the Habbakuk Board if they consider it such a course advisable.

(M.F. Perutz)

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NATIONAL RESEARCH COUNCIL

CANADA

Division of Physics
and
Electrical Engineering

OTTAWA, 20 October, 1943.

Dr. M.F. Perutz,
c/o Secretary,
British Admiralty Technical Mission,
O t t a w a,
Canada.

Dear Dr. Perutz,-

After you left I gave some consideration to the problem of a filler and came to the conclusion that pykrete moulded in the shape of a box without a lid was a reasonable possibility. The "castings" would be somewhat like a laboratory sink. After spreading a pykrete slush for a depth of about an inch over the surface already built, these castings of pykrete would be laid on, bottom upwards. A blast of cold air would be sent through the bottom of the box into the hollow thus formed and the bond to the slush would be made.

I have discussed this idea with Mr. Steeves, and he agreed that it seemed feasible and he made a few farther suggestions. In the first place he advocated casting so to speak a partition in the box, so that when the blocks were put in place the bond between two blocks would come over the partition in the lower one thus removing a strain. Going one farther it [illegible] have two partitions at right

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angles so that the laying of the blocks could be done with staggered joints in both directions. There is no particular limit to the size of these blocks: the number of partitions if more than two at right angles would depend on the thickness of the walls allowed. It is a strength of materials problem to decide what size the blocks should be for a particular wall thickness and a particular distance between the partitions which might then be considered almost as webs.

This leads to another suggestion Mr. Steeves made, namely, the possibility of using hollow blocks on the walls of the structure ten feet from the outside surface. On this question the advice of the authority on the strength of materials and resistance to explosives is necessary. If hollow blocks could be used in part of the forty foot wall, it would be easy to make the walls of the block much thicker and one might even have a whole series of blocks with different wall thicknesses - the ones with the thickest walls being used near the outside and the ones with the thinnest walls being used nearest the filler on the inside. Mr. Steeves contended that any saving in the weight of the blocks used for the forty foot wall not only saved material and transportation of same but it gave buoyance and therefore saved depth in order to get 50 feet of free board. Furthermore hollow blocks save time in manufacture as one can put the freezing liquid inside as well as outside.

There may be difficulty in cutting down on the depth of the structure as that may be needed for strength: I was also doubtful about the use of hollow blocks ten feet in from the surface insofar as explosives dangers are concerned, but Mr. Steeves assures me that the tests show that only an injury of three feet occurs, therefore ten feet of solid block was ample insofar as explosives go. Incidentally, do you know what effect explosives have on a cellular structure? Do the air pockets have any cushioning effect?

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In regard to my contention that 40 feet of solid wall might be needed for strength, Mr. Steeves put up the following argument:- The strength of a wall was no better than the strength of the bond holding the blocks together. Therefore if the bond strength is only 25% of the block strength why not weaken the block by making it hollow? The question it would seem to me that arises is then, whether, at the time the wall breaks, the compression strength or the tensile strength will be the first to go. If it is the tensile strength which would break down first it would seem as though Mr. Steeves' suggestion is worth serious consideration.

However to get back to the possibilities of the hollow block as a filler, there are the following points in its favour.

(1) The block can be moulded in a shorter period of time than the solid block - there is not only less latent heat to remove owing to reduction of material but also the cooling can be applied inside the block as well as on the outside.

(2) The hollow block permits of a method of bonding which seems good if we desire temperatures near 32° when the blocks are put in place because after placing the temperature can be reduced by a flow of cold air inside of the block.

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(3) When we use a hollow block with partitions we can use enormous blocks, say 20'x20'x2', and thus avoid much handling and welding on the job.

(4) The cellular block built into place in the way outlined above is in a sense "a watertight filler" because the water can only get in after the wall has been broken down.

In addition to these four claims for the advantages of cellular filling there is another on which I do not want to lay great emphasis without more consideration, but it would seem that cellular construction might have possibilities for reserve refrigeration ducts if the first line of ducts broke down.

I am enclosing a table giving some relative densities in terms of solid block as density 1.

Yours very truly,

(signed) C.D. Niven

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Tables of comparative densities for hollow blocks 2' x 2' x 2' if the solid block has a density of unity.

Thickness of wall in inches	1	2	3	4	5	6
Density of block having five sides	.19	.36	.51	.63	.73	.81

Table 1.

Thickness of wall in inches	1	2	3	4	5	6
Density of block having three sides	.12	.23	.33	.42	.50	.58

Table 2.

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Progress Report No. 3

Room 71

Harbour Cold Storage - Montreal

Following is a summary of test results together with brief descriptions of test procedure, equipment and materials employed.

Room 71 occupying one end of the cold storage building and containing about 60 by 90 feet of floor space was divided into two rooms by means of a one inch Ten-Test partition with one side maintained at a temperature of near 0 degrees F. and the other near 15 degrees F. With all refrigeration on, the minimum temperature of the cold side was 0 degrees F. with a range upwards of 2 degrees at times. The temperature of the warmer side was maintained by occasionally turning on the brine in one bank of pipes, less than 5% of the available piping. Temperature difference between the rooms was generally 14 degrees F. and could not be increased. Temperatures in each room varied several degrees in different sections depending upon nearness to dividing partition, outside walls and doors. Test temperatures are referred to in the following as 0 degrees and 15 degrees. Actual temperatures were often 1 to 3 degrees higher.

Pulp

Pulp mixtures were prepared by adding water to [illegible] were run through the

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ground wood lap. The first two lots were run through a beater at the Pulp and Paper Research Institute of Canada, but since the greatest pulp content which could be prepared in this manner was about 4%, subsequent mixtures of higher concentration were prepared in our laboratory by churning and grinding the material in metal wash tubs. Pieces of 4 x 4 timber with handles attached at one end were lifted and dropped much like concrete tampers and given a rotary motion while in contact with the saturated lap.

The resultant product appeared somewhat lumpier and less uniform than that prepared in the beater but aside from slightly higher flexural test results the paper mill product did not appear to be superior to the hand product. No doubt paper mill beaters might be modified by additional beating units to handle pulps heavier than 4%.

The mixtures tested contained from 1 to 14% by weight of bone dry pulp but most work was done with the 4, 6 and 8% mixtures. In physical appearance and behaviour these combinations are much like bricklaying mortars of portland cement, although lacking the stickiness and plasticity of the latter. Pulp will settle out and water will drain out of combinations up to 10%. The 4% combination is easily placeable in forms or in layers and can be pumped. As pulp content increases, workability decreases and from 8% up the material is rather gummy and slightly plastic, showing little or no tendency to flow into place. The higher percentages cannot be screeded off or cut to a given elevation with a straight edge as they tear badly, but must be deposited in final position and compacted and levelled by tamping.

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Preparation of Test Pieces

Test pieces were moulded for tension, flexure and bond tests. Those for tension were moulded in wooden forms 2 feet long and 2 inches deep with enlarged ends for gripping the specimens during test. The reduced sections at the center had areas of 6 and 8 square inches.

Beams were cast in wooden forms made of 2 inch lumber with cross sectional dimensions of 4 inches square and length of 43 inches to provide a clear span of 40 inches. Four inch cubes for compression tests were cut from these beams. Additional compression test specimens were cast in watertight paper cartons 3.3 inches in diameter and 8 inches high. Bond test specimens were also moulded in this type of container.

Beams were cast in 2 inch or 4 inch layers. About 24 hours at 0 degrees F. was required for each 2 inch layer. Tension forms filled the full depth of 2 inches also required 20 to 24 hours to freeze throughout. Large beams 4 inches by 8 inches by 85 inches cast in two layers were never completely frozen at the end of the second day.

Early tests showed that for specimens of this size, rate of freezing did not affect strength so that most specimens were frozen at 0 degrees and stored at the desired test temperature several hours or more prior to test.

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All specimens were distorted and swollen out of true dimensions during freezing and were planed and trimmed to size after removal from the forms.

Testing Equipment

Reference is made to quick and slow tests. Quick tests were made in a 60,000 pound double screw Riehle testing machine obtained from McGill University. Since this machine was powered with a direct current motor, it was necessary to install a motor-generator set.

Slow tests, or plastic flow tests, were made in wooden frames equipped with wooden loading beams and metal knife edges so as to have a leverage ratio of 10 to 1. Cast iron scale weights in units of 10, 5, 2 and 1 pound allowed the application of any desired constant loading within the capacity of the wooden frames. The frames were modified to permit of sustained loading tests in compression, tension, flexure, and bond. Adjustable bolts at the frame end of the loading beam permitted it being maintained horizontally during the progress of a test. Wooden loading frames of the type used are not satisfactory for high loads due to the deformation of the wooden parts at connections. For heavy loading or for large sized test specimens metal frames equipped with means of keeping the loading faces parallel would be more satisfactory.

Deformations during slow or sustained loading tests were measured by means of a Goodell-Pratt Inside Micrometer with extension rods up to 12½ inches, reading to thousandths of an inch with an accuracy of about plus or minus .001 inch.

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Comparison of High and Low Pulp Contents

Most of our tests have employed 4, 6 or 8% pulp contents although a limited number of tests were made with higher percentages to tie in our results with those of other work.

A higher pulp content, such as 14%, is definitely superior to the 4 to 8 combinations in tensile strength and flexure under quick loading conditions, while compressive strengths are about the same. For sustained loadings ultimate safe carrying capacity inflexure is governed by plastic flow in compression. Since this is about the same for all percentages within the above limits it would appear that the higher tensile strength of the 14% combination in quick tests is of little or no practical advantage and that selection of pulp content would be dependent upon cost and ease of handling and placing with available equipment. Even 4% eliminates completely diagonal tension failures which so greatly reduce the load carrying capacity of pure ice. Rate of freezing tests do, however, indicate a shorter freezing time for 14% pulp.

Results of Tests

Flexure Beams had a span of 40 inches with third point loading applied through movable head of Riehle Testing machine. Slightly higher average values for 4% are due to inclusion of early tests made with pulp

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prepared at The Pulp and Paper Research Institute. These were close to 1,000 lb. sq. in. All higher percentages of pulp were prepared in the laboratory. A few tests of 4" x 8" beams are shown in a separate tabulation. These were tested with a span of 80 inches and third point loading. All beams failed by tension cracks opening up after there had been considerable deflection due to plastic flow in compression. Only that portion of upper surface of beam between third point loads showed an elastic curve. Portions from end to third points were plane surfaces. Beams reinforced with hooked end steel rods, after deflecting more than 1½ inches while still carrying a good percentage of the maximum load had plane upper surfaces from the fracture toward each end. Figures preceding strength value indicate the number of tests averaged. Table 1 shows results obtained with small beams, Table 2 with 4" x 8" x 80" beams and Table 3 with welded beams built up of small beams. The beams of Table 3 were also welded at the fractured surfaces after the first tests and subsequently re-tested.

Table 1 - Flexure of Beams

Plain beams loaded at 1/3 points

Span 40 inches Cross section - 4"sq. approximately

Speed .10" per minute

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% Pulp	Temp. of Test	No. of Tests	Calculated Modulus of Rupture
1	15 °F	2	205
	0	2	325
2	15	2	400
	0	2	455
4	15	17	750
	0	17	800
6	15	15	625
	0	15	685
8	15	8	730
	0	8	770

Table 2 - Flexure of Beams

Plain beams loaded at 1/3 points

Speed .10" per minute

Span 80 inches - Cross section 4" x 8" approx.

Speed .10" per minute

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4%		6%	
15°	0°	15°	0°
2-430	2-585	1-440	1-625

Table 3 - Flexure of Built-up Beams

Speed .10" per min.

4"x8"x80" Beams built up with 4 - 4 x 4 x 40 beams

Modulus of Rupture

	4%	
	15°	0°
Welded	1-400	1-500
After re-welding	300	410 (Broke outside of weld)
Welded	1-585	1-485
After re-welding	460	360

Compression - After the flexure tests of small beams, broken portions near the supports were cut into 4 inch lengths, forming approximately 4 in. cubes. These were generally stored at both 0 degrees and 15 degrees and tested with the load applied parallel to the freezing surface and perpendicular to the freezing surface. Table 4 includes tests of cubes and Table 5 covers tests of cylinders 3.3" x 8" cast in cardboard containers.

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Table 4

Compression Tests of 4 inch cubes. Speed .10" per min.

	lb. per sq. in.			
	15°		0°	
% of Pulp	Parallel	Perpendicular	Parallel	Perpendicular
4	24-950	24-1250	24-1260	24-1530
6	14-995	14-1165	16-1265	16-1640
8	10-1050	10-1205	10-1380	10-1630
10.5	-	-	2-1535	2-1635

Table 5

Compression Tests of Cylinders

Diameter 3.3" Height 6.5 inches

All values average of 3

Speed .10" per min.

Lb. per sq. inch.

% of Pulp	Frozen at 15° Tested at 15°	Frozen at 0° Tested at 15°	Frozen at 0° Tested at 0°	Frozen at 15° Tested at 0°
4	1110	1130	1410	1480
6	1130	1145	1410	1425

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8	1025	1135	1430	1495

Tension Tests - Test pieces were of two shapes having minimum cross sectional areas of about 6 and 8 square inches. Most specimens were cast in a horizontal position with the freezing surface parallel to the direction of the applied load in testing. Many test pieces were welded once or twice and re-tested. Each value represents the test of one specimen.

Table 6 - Tension Tests

Loads applied parallel to freezing surface

Speed .10" per min.
Areas approx. 6 sq. in.
Pounds per sq. in.

	Tested at 15° F.			Tested at 0° F.		
% Pulp	Original Test	Welded	2nd weld	Orig. Test	Welded	2nd weld
	352	334		350	368	
4	284	271		394	288	394
	258	370		369	343	
	346	244		340	320	
	288	334	170	405	337	
Ave.	303	310		370	331	
6	313	288		335	258	
	480	410		515	475	
	390	325		366	342	
	354	394	352	425	325	
	260	423	274	475	296	
Ave.	360	368		425	340	

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% Pulp	Tested at 15° F Original Test	Welded	2nd Weld	Tested at 0° F. Orig. Test	Welded	2nd Weld
8	466	-		520	438	
	-	328		410	348	
	450	352		545	460	342
	Ave. 458	340		490	415	

	Quick Freeze	0° F. Original Test	Welded
6%	½" layers frozen in wind tunnel	435	342
14%	" " " " " "	(645 (700 (690	252 -broke - outside - weld.
14%	Slow freeze	(625 (520	442

Tension specimens were also cast vertically so that the pull would be perpendicular to the joints and ice planes.

Table 7

Tests of Tension specimens Moulded vertically with ice planes (welds) normal to loading
Speed .10" per min.

Specimen Number	% Pulp	Unit Load Lb. per sq. in.
X 1	4	270
X 1	4	410

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X 1	4	125
X 2	6	199
X 2	6	355
X 3	6	120
X 3	6	290
X 4	6	275
X 4	6	270

In Table 7 results are erratic and there appears to be little relation between pulp content and strength. This is to be expected since layers of pure ice form between successive freezings and the tensile strength of this ice is independent of the pulp content of the original mixture.

Bond Tests - Bond test specimens were made by casting wood or metal rods vertically in watertight cartons about 8 inches high. Quick bond strength of wood was so high that in order to prevent failure of the wood as an unsupported column in push out tests, the test pieces had to be sliced into thin discs slightly over 1 inch high. Steel rods offered no difficulty in full length specimens. In many tests not listed the wood failed in compression without signs of bond failure, even with very short test pieces. Results are summarized in Table 8.

Table 8

Quick Bond Tests - Wood
Testing speed - .10" per min.
6% pulp used in all test pieces

Temp. of Test		No. of Tests Averaged	Bond Stress at Failure lb.per sq.in.
15° F			
	½" diam. round hard wood dowels	6	444
	½" square white pine	3	372
	3/4" square fir	3	305

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Temp.
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0° F

½" diam. hardwood
2 bond failures at average of 640 lb.sq.in.
4 failures of wood in compression at 520 lb.sq.in.

½" square whitepine
In six tests wood failed in compression when bond stress was 361 lb.sq.in.

3/4" square fir
Two bond failures at average of 400 lb.sq.in.

Owing to delays in delivery of forms for freezing the test pieces there was not time to repeat this series in such a way as to get more positive results. Tests of reinforced beams indicated no signs of slippage of wood reinforcement.

Table 9

Quick Bond Tests - Steel
6% Pulp - Speed .10" per min.

	15°	0°
½" diam. smooth steel rod	7 tests ave.134 lb.sq.in.	6 tests av.171 lb. sq.in.
1/4 " " " "	8 tests ave.105 lb.sq.in.	5 tests av.191 lb. sq.in.

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Shear Tests - Shear test specimens were made by welding together the adjacent vertical faces of 3 cubes, the center one projecting about 1 inch above the two outer ones with the bases of the two outer one welded to a piece of 4 x 4 timber to prevent lateral spreading or tilting when load was applied downward on the upper face of the center cube. This test is really a measure of the shearing strength of welding material, or the adhesion of the pure ice film to the surfaces of the cubes. Table 10 is a summary of test results.

Table 10

Shear Strength of Welded Joints
Shear Area about 23 square inches
Speed .10" per min.

Weld Material	Tested at 15°	Tested at 0°
4% Pulp	393 lb.sq.in.	496
6% Pulp	415 lb.sq.in.	537
8% Pulp	454 lb.sq.in.	536

All values average of 5 tests

Shearing Strength of Unwelded Pulp

Tests just completed, but no yet fully computed, indicate the shear strength of frozen pulp (4%) containing no welded joints to be in excess of the values of Table 10 for welded material.

Tension Tests of Wood Used in reinforcing Beams

The one half inch square white pine strips used for reinforcement in some beams were tested by

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embedding the ends in the grip portions of tension test pieces and damming off the center 5 or 6 inches to prevent encasement of the wood. The wood was clear, select white pine free of knots and fairly straight grained. Tests of four pieces taken at random from the supply broke at unit loads of 4600, 7900, 9400 and 12250 lb. per sq. in. This wide variation in tensile strength indicates the chief defect of wood when used as tension reinforcement and helps to explain variation in strength values obtained for wood reinforced beams.

Freezing Rates

Freezing rates together with test conditions are listed in Table 11. Test slabs of about 80 sq. in area were cast in a horizontal position and placed on the floor of the wind tunnel. Air velocities were measured 1 inch above the center of the specimens using a Pitot tube and Friez air meter which allowed direct reading of air speed for any test temperature. Temperatures were measured by means of copper-constantan thermocouples embedded near the bottom of each test layer, using a Leeds and Northrup potentiometer. The freezing times listed in Table 11 represent the horizontal portion of the cooling curve or the time during which the specimen remained at 32 degrees F. Time required to cool down to 32 degrees before freezing begins is dependent on temperature of base upon which test layer is placed, temperature of the pulp, and time required to place test layer and get the air blast in operation.

It would appear useless to attempt to compute

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thickness of layers which might be built up per day without experience with the exact type of equipment to be used in the placing and freezing operation. It is very unlikely that any plant of commercial size could operate at 100% efficiency, i.e. appl. the new layer and blast at the instant the previous layer drops just below 32 degrees F. The lost time in sequence of operations might be an appreciable percentage of the freezing times shown in Table 11 so that actual production could be only a fraction of the theoretical capacity.

Table 11 - Freezing Rates

% Pulp	Thickness of Layer Inches	Air Temp.	Air Velocity	Time for Pulp to Reach 32°	Additional Time for Temp. to Drop below 32°	No. of Tests
6	3/8	4°F	550 ft.min. 6¼ m.p.h.	2 to 4 min.	Ave. 71 min.	3
6	3/8	4 F	1100 ft.min. 12½ m.p.h.	"	" 47.5 min.	5
6	3/8	4 F	0	5	" 247 "	1
6	3/8	15 F	0	5	350 "	1
6	3/8	15 F	1100 ft.min.	4 to 6	" 85	3
6	3/8	15 F	550 ft.min	"	(129	1
14	3/8	4 F	1100 ft.min	2 to 4	(92	1
14	3/8	4 F	550 ft.min.	"	40.2	6
6	1	4 F	1100 ft.min.		55.5	2
					138.0	1

Freezing times for 14% pulp were appreciably shorter than for 6%. The individual results for 6% were also more variable than for 14%. This may be partially due to the thinness of the layers. Even with care in trowelling and smoothing the surface, a variation of 1/16 inch may easily result which is 16% of the total thickness. These tests also indicated that temperature of base on which such a thin layer is placed considerably

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influences freezing time. The test procedure employed in getting this data was standardized and the electrical apparatus functioned perfectly, but more tests should be made before definite conclusions can be drawn.

Tests of Reinforced Beams

Reinforcement consisted of 1/2 inch square white pine, 3/4 inch square fir and 1/4 inch diameter steel rods with straight and with hooked ends. Beams reinforced with wood failed in tension preceded by great plastic flow in compression which resulted in deflection in excess of 1½ inches in a span of 40 inches. Modulus of rupture is computed as for plain elastic beams.

Table 12 - Reinforced Beams

Span 40 inches - 1/3 point loading
Speed .10" per min.

% Pulp	Reinforcement	15°	0°
4	½ inch square tension rod	3 - 1010	1- 905
6	"	-	1-1035
8	"	1 - 1165	1-1015
6	3/4 " " " "	3 - 1110	3-1310
6	3/4 " tension and compression	1 - 1370	3-1590
6	1/4 " diam. steel - straight	2 - 865	1-1150
6	" " " - hooked ends	4 - 855	4-1010

Tests are insufficient in number to permit

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drawing very definite conclusions except that reinforcement has been generally effective in somewhat increasing modulus of rupture. Hooking the ends of the steel rods appears to be ineffective. In two such specimens the looped ends of the hooks broke out through the upper surface of the beam indicating slippage in spite of a hook that is fully effective in reinforced concrete.

Unit Weights of Pulp Mixtures

Since frozen specimens are not uniform in shape or dimensions computations of weight per cubic foot based upon measurements may be appreciably in error and determinations of weight of several samples cut from the same large specimen may differ considerably. The values listed in Table 13 were obtained by computing volume on the basis of displacement of a liquid (kerosene). Samples were approximately 4" x 4" x 8" weighing about 4 pounds each.

Table 13 - Unit Weights

% Pulp			Specific Gravity
4	58.3		
	58.5		
	58.4 ave.	58.4 lb.cu.ft.	.937
6	59.0		
	59.0		
	59.0 "	59.0 " " "	.945
8	58.9		
	58.9		
	58.8 "	58.9 " " "	.944
14 ends of tension	59.5		
specimens	60.4 "	59.95	.960
14	60.0		
	60.1 "	60.05	.960

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Slow Tests - Sustained Loading - Plastic Flow

By means of the wooden loading frames sustained loading tests were made in flexure, compression, tension and bond.

Considerable time will be required for a complete study of the data obtained but certain trends, apparent soon after the tests were started, have persisted so that some general conclusions appear to be established. Owing to delay in delivery of cast iron loading weights this work has been underway about six weeks.

Plastic Flow in Compression

Specimens of 4 to 8% pulp content have been loaded with unit stresses of 100, 200, 300 and 400 lb. per sq. inch. These test pieces were cast in the form of 4 x 4 x 43 inch beams and were cut to the required dimensions as needed. The unit load of 100 lb. per sq. in. was applied to specimens approximately 4 x 4 inches in cross section and 12 inches long. To avoid overstressing the loading frames smaller specimens were subjected to the higher unit loads. For 200 lb. per sq. in the test pieces were about 3 x 3 inches by 7 and for 300 and 400 lb. per sq. in. the dimensions were about 2 x 2 by 6 inches. Tops and bottoms of test specimens were in contact with steel plates above and below which were wooden plates into which nails were driven to serve as gauge points. Gauge points were placed and deformation readings were taken on two opposite sides of the test specimen under the loading beams.

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Measurement of distance from nail head to nail head was made daily by means of the inside micrometer gauge previously mentioned. Readings are probably accurate to plus or minus .001". While the gauge can be accurately read to .0001" such refinement is not justified since variation in the touch of the operator in successive readings may result in differences of as great as .001".

Results to date indicate that there is no great difference between the 4, 6 and 8% pulps and that for stresses not in excess of 100 lb. sq. in. the flow will probably be less than 1% per year. The trend for 6% pulps at both 0 degrees and 15 degrees to date, is less than 3/4 of 1% per year. For 200 lb. sq. in. the rate is higher. Stresses of 300 and 400 lb. sq. in. result in comparatively rapid deformation accompanied by buckling or tilting. This tendency is increased by unavoidable eccentricity of loading and the fact that the upper and lower bearing plates cannot be maintained parallel in the wooden loading frames.

Plastic Flow in Tension

The few tests of plastic flow in tension do not permit drawing definite conclusions except that flow is not great for stresses around 100 lb. per sq. in. One specimen stressed to 50 lb. per sq. in. for 30 days showed no deformation. Another stressed to 100 lb. per sq. in. showed a decrease in length of .010" in a gauge length of 12 inches in 30 days. A third test piece stessed to 150 lb. per sq. in. showed an elongation of .006" in 12" in 7 days, but showed no further increase during the next week. These three specimens were made of 4% pulp. A 6% specimen still under test has elongated .013" in 12 inches in 24 days, which is a rate of about 1.9% per year. The tensile strength in quick tests varies from 260 to 480 lb. sq. in. These tests were made at 15 degrees F.

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Sustained Bond Stress

Bond test pieces of wood and steel similar to those reported in quick tests were subjected to sustained loading in the wooden loading frames. Since it was necessary to make the wooden projections very short to avoid compression failures measurements were taken between the under side of the loading beam and the steel plate upon which the base of the test specimen rested. Measurements of deformation are made up of compression of top of rod above the pulp, plastic flow of frozen pulp in contact with surface of rod and slippage between rod and pulp. Both wood and steel, loaded so as to have a computed average bond stress up to 75 and 50 lb. per sq. inch respectively, showed slight deformation for a few days after which no further shortening occurred. In view of the high quick test bond values for wood no bond failure should be expected but 50 lb. sq. in. is a rather high percentage of the ultimate quick bond strength for steel.

Sustained Loading in Flexure

Little information has been obtained on plastic flow in bending owing to the late start on sustained loading tests. Beams of 4% pulp loaded so as to result in a computed extreme fiber stress of 100 lb. sq. in. ceased to deflect and gave a horizontal line for the deflection-time relation in less than a week, at temperatures of 0 degrees and 15 degrees F. The beams at 15 degrees were then loaded to increase the stress to 165 lb. sq. in. and further deflection ceased

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increased to result in a stress of 300 lb. sq. in. and during the next week deflection increased at a steady rate with no sign of a flattening out of the time-deflection curve. Other and later tests with fiber stress of 100 lb. sq. in. have shown a tendency to continue deflecting for a longer period of time but at a decreasing rate. Further increase of loads to result in stresses of 150 and later 200 lb. sq. in. has caused continued deflection but at a decreasing rate as compared to that which occurred at the lowest stress. These tests, limited in number and in duration, appear to indicate that deflection will not be great or continuous for loads causing stresses of about 100 lb. sq. in. Such a conclusion would not be inconsistent with the one previously stated for plastic flow in direct compression.

Sustained loading has been applied to only two reinforced beams, one reinforced with a ½" square tension rod and one with tension and compression rods 3/4" square. Both continued to deflect slowly throughout a two week test period, the latter at a slightly lower rate than the one reinforced on the tension side only. That plastic flow cannot be entirely eliminated by the use of reinforcement, is also borne out in the direct compression tests where specimens at both temperatures, reinforced as columns, continued to slowly shorten throughout a two week test period under a unit stress of 200 lb. sq. in.

Many test results of compression tension and flexure, not included in the preceding tables, may slightly alter average values when the final report is prepared but will not modify any conclusions which may be drawn from this progress report. Other tests, not included here, have furnished information on physical characteristics of minor importance.

GMM:BW
Sept.2/43

(signed)
G.M. Williams

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TO: Mr. J.W. Rivett

FROM: E.S. Green

SUBJECT: HABBAKUK

SUBSECTION: HABBAKUK II - Report on Visit to Canada.

REFERENCE: H/5171

DATE: 18th October, 1943.

With Dr. Perutz, I visited the National Research Council, Ottawa, on the morning of the 11th and met Dr. Cook and Mr. Steeves. A good deal of the discussion concerned the manufacture of pykrete and the strength of the material, which will be reported on separately by Dr. Perutz. The various aspects of the hull problem were discussed at some length including all the various difficulties which have to be overcome.

No new problems were brought up either by Dr. Cook or Mr. Steeves, with the exception of a suggestion made by Dr. Cook and agreed to by Mr. Steeves, that it would not be practicable to have the hull maintained by air ducts in the form of

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at Jasper that the bottom portion of some of their air pipes had become choked with snow. This they thought was due to condensation of the moisture drawn into the circulating system. I was very surprised at this statement, as this was a state of affairs I did not anticipate, and further reference is made to this later in this report.

Dr. Cook explained that he had been away from Ottawa for some months and had not been in close touch with the project during that time, and although both he and Mr. Steeves had seen the Jasper model during its early stages they had not had an opportunity of studying any of the information obtained during the maintenance period. Dr. Cook stressed the difficulty (of which we are all fully aware) of repairing damage to the insulation below the water line. He had apparently been thinking of the same method of secondary protection which I had suggested in London, and which had at that time been discarded, namely, introducing a second line of insulation between the outer and inner systems of air pipes and also sub-dividing the outer thickness of pykrete, by insulated walls, into a number of sub areas equal to say, the area dealt with by each sub section of air ducts.

A day or two previously, Dr. Cook had been handed by Dean MacKenzie the preliminary report by Dr. Williams of Saskatoon, on strengths of pykrete mixtures. Dr. Cook had not been carefully through this report and handed it to us to read. Reference is made to this below and a full report will be given by Dr. Perutz.

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Later, we were introduced to Dr. Niven, who had been up at Jasper since the time the model was constructed, until a few weeks ago, and had been responsible for all the readings taken up there and for practically the whole of the construction. We then were shown samples of their pykrete with different percentages of pulp - these will be reported on by Dr. Perutz.

At a second meeting with Dr. Niven he explained the method of construction of the model at Jasper and mentioned the difficulty they had had in finishing the model before the thaw and also in getting the refrigerating plant into operation before the ice at the bottom had entirely melted due to heat penetration from the lake water. He was of the opinion that a good deal of the ice had in fact melted and that since some of the air ducts were not absolutely water-tight they had become flooded with water and could not be used for air circulation. He did not agree that any of the ducts became choked with condensed moisture during the time the model was in operation. In fact he expressed the reverse opinion, being fairly sure that where moisture had frozen in some of the air ducts but had not entirely choked the air passage, the ice formation gradually evaporated, improving the air circulation which is a state of affairs one would expect. He had figures showing the amount of moisture [illegible] drained away from the cooler

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which had thawed [illegible]
every day. This was a considerable amount, but he felt that this could, to a very considerable extent, be explained by leakage into the air circulating system from the outside atmosphere. It must be borne in mind that the air ducts on this model are made from metal stove pipes with soldered joints and painted with bitumen paint, and therefore are not liable to pass water vapor from the ice into the air circulating system. Dr. Niven suggested that to ensure a good weld between two blocks of ice or pykrete that it would be advisable for them to be nearly at melting point, in fact he went so far as to suggest that if it were practicable the pykrete should be laid when at a temperature just below freezing point, the mortar laid and the whole frozen together and cooled down to the lower temperatures by means of the cooling system in the hull. Actually, this is not a practicable solution. It is, however, interesting to note that Dr. William's report on strength of materials and welds show a very high strength for his joints and it is to investigate this point further that Dr. Perutz has proceeded to Saskatoon.

Dr. Cook was very critical of suggestions made of using paper ducts for the air flow within the pykrete. He went to some considerable extent to explain how it would be impossible to obtain a vapor proof lining to these ducts, and we would therefore experience a continual evaporation of the ice from the pykrete in the form of water vapor.

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During our interview with him the next day, however, he went to considerable extent to provide us with information of suitable papers which could be used for lining air ducts to make them practically vapor proof.

At the N.R.C. they have been doing a considerable amount of work with various types of papers for wrapping desicated foods and are therefore in a position to give us some very valuable advice. Dr. Perutz is having sent back with his papers some samples of the various papers proposed.

Mr. Steeves, at some time in the past, proposed for the final ship, a cooling system involving pipes through which a cold fluid would be circulated, and both he and Dr. Cook expressed the opinion that they felt that this would be a better proposition than one involving air ducts. I was shown a sketch drawing of a part of this system and given a general outline of how the distribution would be effected and the precautions they had taken to enable a section to be isolated in the event of damage. They admitted that there was a vast number of valves and fittings involved, and on the whole I feel that the air duct system will be far the simpler. It is, however, unfair to condemn the other system without having had the opportunity of going into it in much greater detail.

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We returned again on Tuesday morning, and had an interview with Dean MacKenzie. This was only on generalities of the project, during which he expressed the opinion that the scheme had now developed to a stage where it had become an engineering problem rather than a scientific one. The meeting however, was quite cordial, and we returned again in the afternoon when I contacted Mr. Steeves with a view to checking up on the problem of condensation in the air ducts. He then seemed to be less sure of his ground and agreed that providing we could ensure that any leaks into the system took place before the air passed through the air cooler then there should be little fear of moisture condensing on the walls of the ducts. Although he did not say so directly, I gathered that he had not discussed the whole job with Dr. Niven since his return.

I saw Dr. Niven again and he re assured me that there had been no signs of these ducts choking and referred to the fact that in one of the main air ducts there had been a collection of snow when they

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first put the plant into operation, and that this snow had disappeared in the course of time. Dr. Niven had not made any attempt to calculate a heat balance and I feel that any such attempt would be futile as quite a large percentage of the output of the plant is undoubtedly taken up in dealing with air infiltration and heat infiltration into the main ducts arranged in the machinery well of the model.

A very novel system of cooler defrosting had been developed by Mr. Steeves and used on the coolers of the Jasper units for the first time with great success. This is now being used on a small commercial plant on board ship with equal success.

During our early discussion with Dr. Cook and Mr. Steeves, we touched upon the question of insulation and they expressed the opinion that further consideration should now be given to cork of which they believed there was an ample supply in the United States.

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(signed)
E.S. GREEN

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TO: J.W. Rivett

FROM: R.W. Wright

SUBJECT: HABBAKUK

SUBSECTION: HABBAKUK II - PROPOSED CONSTRUCTION OF CONCRETE

REFERENCE: H/5210

DATE: 25th October, 1943.

The basic strategical requirement was for a large floating carrier from which large numbers of bomber or fighter aircraft could operate, which would act as a refueling and repair station and be invulnerable to attack from under water and service craft or from the air. -

In order to satisfy requirements, a vessel having a minimum length of 2,000 feet with a breadth of from 200 to 300 feet at the flight deck was necessary. To build such a vessel by existing means would require an enormous amount of steel. As it was absolutely essential from the point of view of supply at that time to conserve the use of steel, a new material known as Pykrete, the result of considerable scientific research, came into being. This emanated from a proposal to build such vessels in ice -

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The proposal to build Habbakuks in reinforced concrete was given no detailed consideration since it would require as much and probably more steel than in an all steel ship. Although in the preliminary stages of the pykrete design a certain amount of steel reinforcement was considered necessary, as the design progressed it was discovered that based on methods of calculation usually applied to reinforced concrete beams an enormous quantity of steel in excess of first considerations would be required. It was therefore essential to view the problem from another angle assuming the "Pykrete" to take the whole of the tensile and compressive stresses. This was done and an extremely low bending stress of about 87 lbs. per square inch was obtained. Laboratory tests on solid blocks of pykrete gave a tensile stress of 700 lbs. per square inch. Thus, assuming that this stress could be maintained in the full sized structure a factor of safety of 7 was obtained which was agreed to be satisfactory. This therefore, meant a tremendous saving of steel and it was decided to carry out further research work on the new material for the construction of Habbakuks. If, however, owing to changed conditions it is thought no longer necessary to view the steel situation in the same light and the quantity necessary for the construction of a concrete Habbakuk can be easily obtained, then there should be no reason why such vessels constructed in this material should not be given due consideration. This has been done by the U.S. Navy Department Section of the Habbakuk Board, and drawings prepared by the Bureau of Yards and Docks, copies of which the writer has before him. From the Naval Constructors' point of view the designs are

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extremely interesting and the writer would like to make the following comments with the hope that they may contribute a little towards its further improvement.

The hull form, as indicated on the drawings, would prove to be unduly resistful and a considerable saving in power would be achieved for any given speed by fining the underwater portions of the hull at the bow and stern to give better entrance and to reduce the serious eddy making resistances at the stern. In order to get as great a width as possible at the ends of the flight deck, the end sections could be of "V" form. The hull form should be similar to that given on the lines drawing for Habbakuk II, allowing for the reduced breadth. The radius of the bilge should also be increased to improve the streamline flow in that vicinity. As an example of what can be done in this direction, the tow rope resistance for the final form of Habbakuk II was only 36½ percent of that required for the original form with only slightly reduced displacement. It is assumed that a model of the proposed design would be tried in the experimental basin.

The space allotted to main propelling machinery is much more than would be required since for a design in reinforced concrete it would be better and more expedient to use steam turbine installations [illegible] engines. It would be possible to

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rather than Diesel Engines. It would be possible to get a speed of 8½ or 9 knots for an expenditure of about 40,000 horse power, equivalent to the power required for one ordinary destroyer. The space required for two complete turbo electric installations to supply the whole of the power necessary would be no more than two 200 feet compartments, one forward and one aft.

For a ship of this length, the writer is of the opinion that in addition to the forward bridge and navigating position, an after bridge should be fitted, not only for navigational purposes should the forward bridge suffer damage, but also as a control position for aircraft landing or taking off. These two islands would also house up-takes from boiler rooms, ventilation trunks, etc.

Sub division of the hull has been carried out almost to perfection, both transversely and longitudinally but the writer would suggest an additional longitudinal on the centre line in the double bottom in order to break up the free surface of any water which may enter or oil carried in the bottom. The vessel has ample stability.

The hull thickness of eight feet should withstand explosions from torpedoes or mines without serious damage, and repairs at sea could be carried out with special apparatus. The problem of maintaining

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the complete hull with a complicated system of refrigeration does not exist.

The securing of the propelling units to the ships side would present little difficulty.

The choice of building site would not be so restricted as with Habbakuk II, but there still remains the problem of launching although the displacement of the concrete proposal appears to be about 1,150,000 tons, a little more than half that of the Pykrete vessel. It would be interesting to know the total approximate weight of steel reinforcement considered necessary. The question of directional stability is worthy of special consideration since no form of rudder has been indicated on the drawings. This, of course, depends on the degree of manoeuverability required since steering can be carried out with the propellers.

(signed) (R.W. WRIGHT)

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C O P Y

U.S. SECRET

BRITISH MOST SECRET

TO: J.W. Rivett

FROM: M.F. Perutz and E.S. Green

SUBJECT: HABBAKUK

SUBSECTION: HABBAKUK II - Comments on Captain W.H. Smith's Memorandum on Pykrete Production.

REFERENCE: H/5215

DATE: 27th October, 1943.

Captain Smith's memorandum embodies the proposals contained in Mr. Thompson's report and carries them further by sketching out a plan for a complete pykrete factory, starting from cord-wood and finishing with planed pykrete blocks. Moreover, it contains quantative estimates of the machinery, equipment and power required to operate such a factory. We have no comments to make except as regards a few points of detail.

Referring to paragraph 3. The capacity of 50 tons per day for a large rotary filter machine does indeed refer to dry pulp; with a pulp concen-

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[illegible] sufficient in the case of spruce pulp, one rotary filter machine would have an output of 500 tons of pykrete per day, provided the output could be stepped up in direct proportion to the wetness of the pulp.

Referring to paragraph 7. As pointed out in H/5213, the freezing times which we determined in England were too low and had to be increased by 50%, necessitating an increase in total length of the freezing tunnel to 240 feet if an output of 100 tons per day per unit is to be maintained.

The rate of production of the vat machine is given in the report as 12 to 15 feet per minute. It appears that this figure is somewhat low and that a machine of this type can attain an output of 60 feet per minute or more. This increase in speed of the vat machine, coupled with the increase in freezing time, would necessitate a tunnel 700 feet long which would, of course, have to be sub-divided into separate refrigerating units. On the other hand, only three vat machines and not 12 would be needed for an output up to 1500 tons per day.

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Referring to paragraph 8. The air circulation of 70,000 cubic feet per minute for each unit, presumably was calculated to give the required velocity of 17.5 miles per hour over the material. This quantity should be increased to 170,000 cubic feet per minute for an output of 100 tons of pykrete per day if the temperature range of the air is to be kept within reasonable limits, say 8 to 10°F between the inlet and outlet of the unit. If the output of each unit is stepped up to about 500 tons of pykrete per day, the air circulation per unit will need to be 850,000 cubic feet per minute and the output and size of the refrigerating plants increased in proportion.

Finally, in estimating the total refrigerating equipment to be built, account has to be taken of the need to sub-cool the pykrete blocks to 0°F or below. This could be done either by leaving the finished blocks in the

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refrigerating tunnels after they have reached their full thickness, or by passing the blocks through a special cold storage channel before they pass on to the shipyard. The length of time required to sub-cool the block after manufacture is completed will have to be determined experimentally when the method of sub-cooling can be decided upon.

(signed)
(M.F. Perutz)
E.S. Green

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BRITISH MOST SECRET
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BRITISH ADMIRALTY DELEGATION
Seventeenth Street and Constitution Avenue
Washington, D.C.

To: Rear Admiral Ben Moreell (CEC) USN
Chairman of Habbakuk Board

From: J. W. Rivett

Subject: TENTACLE

Subsection: Habbakuk IV - Report to Prime Minister on
Landing and Take-Off Trials by R.A.F.

Reference: H/5229

Date: 29th October, 1943

Attached are copies of the papers giving the reports on the landing and take-off trials conducted on the marked out area at an R.A.F. Station in England.

These are the papers mentioned by Commodore McCall, R.N. and myself at this morning's Board meeting.

/S/ J. W. Rivett

(J.W. Rivett)

JWR/dr

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MOST SECRET

OFFICES OF THE WAR CABINET

GREAT GEORGE STREET

S.W.1

- MOST SECRET -

ADMIRAL SIR PERCY NOBLE

I am directed by the Deputy First Sea Lord to forward the attached copy of a report to the Prime Minister on project TENTACLE, and to request that you will communicate the information contained therein to the appropriate American Authorities, in particular the opinion expressed in paragraph 5 of the covering note.

Signed G.H. OSWALD
Commander
Secretary, Floating Airfields
Committee.

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SAFETY FILM KODAK

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13nd October, 1943.

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PRIME MINISTER

The detailed results of the full scale flying trial held at R.A.F. Station FORD are annexed (Flag 'A'). These results have been carefully considered by my Committee, together with your remarks on the trial and the following preliminary conclusions have been reached.

1. TENTACLE must either be equipped with arrester gear or a landing strip at least 2250 feet in length must be provided.

2. As regards the question of under and over shooting which you raised, the qualified deck landing control officer ("BATSMAN"), who was provided to control landing and so to make use of the full length of the landing strip, has a very difficult task in judging just when to wave away a landing aircraft. His task would be easier if all pilots were trained in deck landing which was not the case, but it should be noted that 4 out of 12 Fleet Air Arm pilots, all of whom were instructors in deck landing, overshot by amounts varying from 5 to 70 yards. For this reason the opinion expressed at 1 above is a firm one.

3. The minimum length of the strip is 1800 feet even if arrester gear is provided. This is governed by the necessary space for taking off under adverse atmosphere conditions and no wind.

4. It is hoped to get considerable information from the trials now being carried out in the U.S.A. A copy of a short questionnaire which has been sent to the British Authorities there is attached (Flag 'B').

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5. It is considered that construction and handling will be simplified if the structure consists of a rectangle 260 feet wide rather than the present narrower strips. This opinion will be transmitted to America for their comments.

6. The opinion is still firmly held that 4 squadrons of fighters is the maximum number which can be operated from a single floating airfield.

7. Preliminary investigation of an airfield constructed from concrete barges has been made. A rigid and an articulated type have been considered. There are very serious objections to the rigid type and investigation is therefore concentrated on the other design. It is evident that very considerable facilities would be necessary for such construction in India and the Commander-in-Chief, Eastern Fleet has been asked to provide information about, resources for a project of this scope in India. The provision of the necessary tugs for towing the barges across the Indian Ocean and operating the airfield would be a very heavy commitment inseparable from this project.

8. It is our opinion that the concrete articulated TENTACLE could in no case be completed before early 1945 and might therefore prove superfluous in view of the large number of aircraft carriers which will be available by that time.

9. A further report and recommendations will be submitted as soon as information is obtained from America and India.

Deputy First Sea Lord.

21st October, 1943.

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ANNEX I

1. The following report on the floating airfield demonstration held at the R.A.F. Station, Ford on Friday, 15th October, 1943 has been prepared by the Director of Air Tactics, Air Ministry and the Director of Air Warfare and Flying Training, Admiralty.

DIMENSIONS

2. The dimensions were as follows;

(i) A replica of the floating airfield was laid out on the airfield and marked by ground strips and flags in accordance with the drawing at Appendix 'A'. Dimensions were - length of landing strip 1,800 ft. width of landing strip 175 feet, length of parking strip 70 feet, distance between landing strip and parking strip 100 feet, width of communicating strips 50 feet.

(ii) Parking strip. The width of the parking strip (70 feet) was 20 feet greater than the originally planned measurement as it was considered that any lesser width would result in an unacceptable accident rate. This was borne out by experience.

(iii) Repair strip. In addition, it was considered essential that the landing strip should be kept cleared to allow the unobstructed take-off and landing of high performance aircraft. A third strip, or "repair strip", to take damaged or unserviceable aircraft was accordingly marked out of equal dimensions to the parking strip and on the other side of the landing strip.

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(iv) Arrester gear. As it was not known whether the use of Arrester gear would be necessary on the floating airfield, the landing strip was marked off at 300 ft. intervals from the 1,800 ft. mark, in order to give an indication of the length of the run needed for aircraft taking off and landing on the floating airfield.

CONDITIONS OF USE

3. (i) There appear to be two distinct ways in which the floating airfield could be used for the operation of aircraft: -

(a) As a "floating home", or

(b) As a refuelling and rearming strip, aircraft returning to their home bases at night.

(ii) On the assumption that the floating airfield was to be used by aircraft as a "floating home" it was estimated that not more than four squadrons (48 single engined aircraft) could be operated. In this case the limiting factor being the number of aircraft that could be parked on and operated from the parking strip.

AIRCRAFT TAKING PART

(i) Accordingly, 4 squadrons (48 aircraft) consisting of the following types took part in the demonstration:

12 F.A.A. Seafires - flown by Naval Instructions
12 Spitfire IX's - No. 485 (New Zealand) Squadron
12 Spitfire V's - No. 416 (Canadian) Squadron
12 Spitfire V's - No. 412 (Canadian) Squadron

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(ii) Loading. All aircraft were fully armed and carried full fuel tanks. The twelve Spitfire IX's of No. 485 Squadron carried full 30 gallon auxiliary long range tanks in addition to normal full capacity.

(iii) Pilots' experience. The Fleet Air Arm Seafires were flown by Naval pilots experienced in actual deck landing conditions. In regard to the R.A.F. Spitfire squadrons, it was not possible for the purposes of the demonstration to find sufficient pilots with previous deck landing experience. Out of the total of 36 R.A.F. pilots, therefore, only 50% pilots had had elementary deck landing training, including landings on the deck of a carrier.

TIME-KEEPING

4. In order to find out the time taken for flying off, landing on and refuelling and rearming of the four squadrons taking part, a representative of the Operational Research Section, Fighter Command kept a detailed record of the timing of each individual operation and the results.

DECK HANDLING PARTY

5. This consisted of a party of 80 trained Naval ratings.

REFUELING AND REARMING

6. This was carried out by a party of R.A.F. Servicing Commandos. Refuelling was carried out from eight refuelling bowsers.

FLYING PROGRAMME

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7. The programme was divided into two parts: -

PART I was designed to demonstrate the maintenance of a standing patrol of two squadrons over supposed assault operations. At zero hour, therefore, two squadrons took off in quick succession. At zero + 15 - an interval to represent one hour's patrol over the beaches - the remaining squadrons took off in succession.

PART II was designed to demonstrate the operation of aircraft under conditions which might necessitate producing the maximum effort of four squadrons over the assault area. This part of the demonstration, therefore, showed the landing on, quick refuelling and rearming and flying off of all four squadrons in quick succession.

SPECIAL DEMONSTRATION

8. In order to demonstrate the landing and take-off of other types of aircraft in relation to the floating airfield the following types carried out a special demonstration at the conclusion of the programme: -

Beaufighter I
Mosquito VI
Fulmar II
Hurricane IV
Mustang II
Typhoon
Spitfire XII

Results are shown in paragraph 9 of Appendix 'A'.

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CONTROL OF FLYING

9. (i) All landings were controlled by a F.A.A. "Batsman".

(ii) All flying from the floating airfield was under the control of a Naval Commander Flying, assisted by an R.A.F. Squadron Leader and Naval Lieutenants as executive officers.

(iii) When in the air all squadrons were controlled by R/C from pack sets situated close to the F.A.A. batsmen.

RESULTS

10. A complete summary of the results and timing of the different operations is given in detail in Appendix 'A' to this paper. Briefly -

(i) Take Off. All aircraft took off safely. Average time 2-3/4 minutes per squadron.

(ii) Landing. 46% of the aircraft overran the end of the landing strip. Average landing time 4-3/4 minutes per squadron.

(iii) Refuelling and rearming. 46 aircraft were refuelled and rearmed in 26 minutes.

APPENDIX 'A'

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FLOATING AIRFIELD DEMONSTRATION - TIMING OF OPERATIONS

RESULTS

Initial Take-Off

1. All the aircraft engaged - Seafires and Spitfires V and IX (the IXs only with long range tanks) - took off safely from the landing strip without overshooting.

2. With aircraft taking off singly and no hitches occurring the time taken for a Squadron of 12 aircraft to become airborne varied from 1 min. 38 secs. to 3 mins. 58 secs.

3. The time taken for the first pair of Squadrons (comprising 22 aircraft) to take off was 6 mins. 19 secs., and for the second pair of Squadrons (comprising 24 aircraft) 7 mins. 12 secs. These times are worse than those for the Practice Exercise due to a collision in the taxying strip between two aircraft of the second Squadron. The accident caused about 2½ mins. delay in the take-off of the second Squadron and probably had an influence on the pilots in the second pair of Squadrons in making them preserve a greater distance between aircraft while taxying.

Landing

4. The following aircraft overshot on landing: -

Seafires	- 4 out of 12
Spitfires Vs	- 9 out of 24
Spitfires IXs	- 8 out of 10

In addition, 1 Spitfire IX and 1 Spitfire V landed short of the landing strip.

Thus, 23 out of 46 aircraft became "casualties" on landing.

The distances of over-shooting, measured in feet, were as follows: -

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4 Spitfires	-	30:	225:	15:	210
5 Spitfires Mark VB	-	60:	450:	225:	75: 240
8 Spitfires Mark IX	-	315:	120:	540:	180: 390:
		240:	165:	420	
4 Spitfires Mark Vc	-	90:	75:	120:	420

1 Typhoon - 300)
1 Spitfire Mark III - 300) Demonstration Aircraft.

5. The time taken for a full Squadron to land varied from 3 mins. 46 sec. to 5 mins. 36 secs.

6. The time taken to land on the four Squadrons (46 aircraft) was 21 mins. 15 secs.

Second Take-Off

7. The four Squadrons (still 46 aircraft) took off without hitch in 12 mins. 58 secs., the times for the individual Squadrons varying from 2 mins. 15 secs. to about 3½ mins.

Refuelling and Rearming

8. The 46 aircraft were refuelled and rearmed in 26 mins. so that no delay was caused in the second take-off which commenced immediately after all the aircraft had landed. The rearmament party finished 1 min. ahead of the refuelling party.

Special Demonstration

9. The Beaufighter, Mosquito, Fulmar, Hurricane, Mustang and Typhoon and Spitfire XII (the last two with long range tanks fitted) took off safely. On landing the Hurricane and Mustang touched down short of the landing strip, and the Typhoon and Spitfire XII overshot. Thus 4 out of the 7 became "casualties" on landing.

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FLOATING AIRFIELD DEMONSTRATION FORD - 15th OCTOBER, 1943

MOST

TIMING OF OPERATIONS

		INITIAL TAKE-OFF			LANDING (4 Sqns in succession)			SECOND TAKE-OFF (4 Sq	
Sqn.	Aircraft	First Aircraft Airborne*	Last Aircraft Airborne*	Time to Scramble Squadron	First Aircraft Landed*	Last Aircraft Landed	Time to Land Squadron	First Aircraft Airborne*	Last Aircraft Airborne*
				Mins.Secs.			Mins.Secs.		
FAA	Seafires	00.05	01.43	1.38	30.50	34.36	3.46	53.48	56.03
485	Spit.IX	01.53	01.24†	4.31 (10s/c. only)	36.02	40.09	4.07 (10s/c. only)	56.18	59.28
416	Spit.VC	15.07	18.04	2.57	41.16	45.52	4.36	61.11	63.42
412	Spit.VB	18.21	22.19	3.58	46.29	52.05	5.36	63.59	66.46
			INTERVAL						

* The times in this column represent minutes and seconds after zero-hour, which was 15 hrs. 6 mins. 40 secs.

† While moving along the taxy strip two aircraft of this Squadron collided and the taxy strip was blocked unt both were moved off the strip. The first six aircraft of the Squadron were airborne in 56 secs. and the la four in 51 secs.

WEATHER. Visibility: 4 miles
Wind: Light southerly, 5 - 10 m.p.h. (Across landing strip)
Cloud: 2/10-3/10ths, base 3,000 feet.

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FLOATING AIRFIELD DEMONSTRATION FORD - 15th OCTOBER, 1943 MOST SECRET

TIMING OF OPERATIONS

	LANDING (4 Sqns in succession)			SECOND TAKE-OFF (4 Sqns in succession)			
raft orne*	Time to Scramble Squadron	First Aircraft Landed*	Last Aircraft Landed	Time to Land Squadron	First Aircraft Airborne*	Last Aircraft Airborne*	Time to Scramble Squadron
	Mins.Secs.			Mins.Secs.			Mins.Secs.
43	1.38	30.50	34.36	3.46	53.48	56.03	2.15
24+	4.31 (10a/c. only)	36.02	40.09	4.07 (10a/c. only)	56.18	59.28	3.10 (10a/c. only)
04	2.57	41.16	45.52	4.36	61.11	63.42	2.31
19	3.58	46.29	52.05	5.36	63.59	66.46	2.57
AL							

epresent minutes and seconds after zero-hour, which was 15 hrs. 6 mins. 40 secs.

y strip two aircraft of this Squadron collided and the taxy strip was blocked until rip. The first six aircraft of the Squadron were airborne in 56 secs. and the last

miles
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/10-3/10ths, base 3,000 feet.

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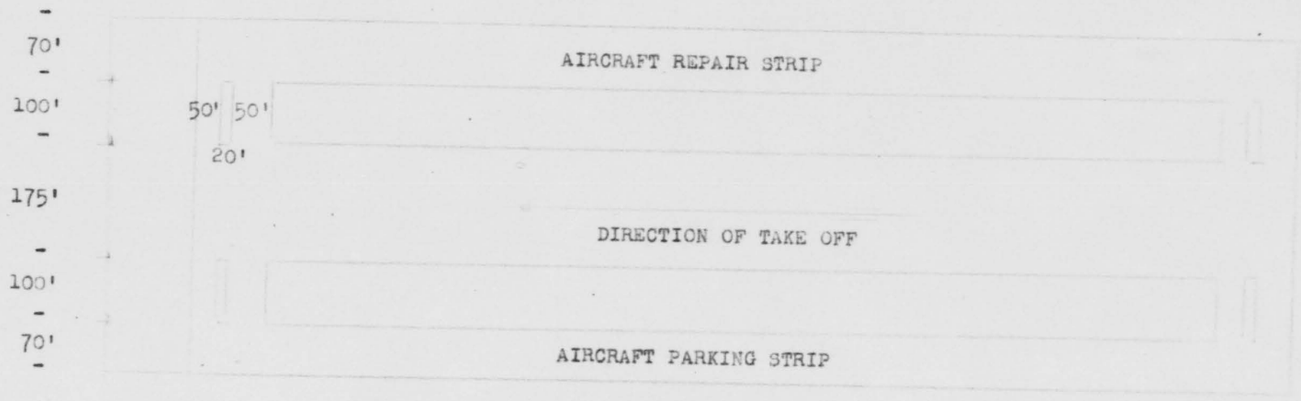
APPENDIX 'B'



PROPOSED LANDING STRIP, PARKING AND TAXYING STRIPS.

Scale 1" = 200 feet

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APPENDIX 'B'

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AIRCRAFT REPAIR STRIP

DIRECTION OF TAKE OFF

AIRCRAFT PARKING STRIP

PROPOSED LANDING STRIP, PARKING AND TAXYING STRIPS.

Scale 1" = 200 feet

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ANNEX II

From: Admiralty

To: B.A.D. Washington, repeated B.E.A.C.

FLOATING AIRFIELD

It is desired to obtain the following information from the trials which it is understood are now being carried out in America:-

(i) Tide and wind conditions, mooring and/or tug arrangements, including method and time taken for turning the assembly into the wind and holding it there.

(ii) Dimensions and draught.

(iii) Is arrester gear necessary and if so what type operated.

(iv) Number of individual units and speed of assembly.

(v) Number and types of aircraft which could be operated.

(vi) An opinion as to the maximum sea conditions in which the assembly could be operated.

(vii) Accurate measurements of the bending of the platform under waves of measured height and length.

(viii) Determination of the free period of oscillation of the platform, and the effect on this of partial flooding of two units.

(ix) The effect of explosives.

In order to get the best results from the bombing trials, it is suggested that model experiments should first be done, followed by gradually increasing placed charges on the floating airfield rather than full scale service bombs.

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IN REPLY ADDRESS
THE BUREAU OF YARDS AND DOCKS
AND REFER TO No.

(SC)N18-5/A1-1
D-1/jw
YD Serial 01431

NAVY DEPARTMENT
BUREAU OF YARDS AND DOCKS
WASHINGTON, D. C.

SECRET

4 November 1943.

From: Chairman, Habbakuk Board.
To: Brigadier General Glen C. Jamison, USAAF.

Subject: Habbakuks - Board to Construct Section, Continue Design and Study Construction and Facilities for.

1. Meeting No. 3 of the subject Board will be held at 1000 on Friday, 26 November, in Room 3601, Navy Building.

W. H. Smith
Secretary

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IN REPLY ADDRESS
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AND REFER TO No.

(SC)N16-6/A1-1
D-1/Jw
YD Serial 01432

NAVY DEPARTMENT
BUREAU OF YARDS AND DOCKS
WASHINGTON, D. C.

SECRET

4 November 1943.

From: Chairman, Habbakuk Board.
To: Brigadier General Glen C. Jamison, USAAF.

Subject: Habbakuks - Board to Construct Section, Continue Design and Study Construction and Facilities for.

1. Forwarded herewith are Enclosures (1) and (2) for your information and consideration.

W. H. Smith
Secretary

Encl. 1. Copies of four memoranda prepared by British Technical and Scientific advisors.
2. Copies of reports on landing and take-off trials conducted on the marked out area at an RAF station in England.

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IN REPLY ADDRESS
THE BUREAU OF YARDS AND DOCKS
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YD Serial 01419

NAVY DEPARTMENT
BUREAU OF YARDS AND DOCKS
WASHINGTON, D. C.

2 November 1943.

SECRET

From: Chairman, Habbakuk Board.
To: Brig. Gen. Glen C. Jamison, USAAF.

Subject: Habbakuks.

1. Forwarded herewith are Minutes of Habbakuk Board Meeting No. 2, 29 October 1943.

W. H. Smith
Secretary

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SECRET

MINUTES OF MEETING NO. 2
HABBAKUK BOARD

Board met at 1000, 29 October 1943, Room 3801, Navy Building.

Present:

Rear Admiral Ben Moreell, CEC, USN.	Chairman
Captain William H. Smith, CEC, USN.	Secretary and Deputy
Rear Admiral Edward L. Cochrane, USN.	Member
Rear Admiral Charles L. Brand.	Deputy
Commodore H.N.U. McCall, DSC, RN.	Member
Group Captain J.W.F. Merer, RAF.	Deputy
Mr. J. W. Rivett.	Member
Air Vice Marshal G. V. Walsh, MBE, RCAF.	Member
Group Captain A.L. James, RCAF.	Deputy
Captain V.S. Godfrey, RCN.	Deputy
Captain Calvin M. Bolster, USN.	Deputy
Major W.N. Burgoyne, USAAF.	Deputy

Admiral Moreell stated that the purpose of the Board Meeting was to review the things done since the first meeting on 12 October and to read the monthly report, preparatory to forwarding it to the convening authority. He read the drafted Report and enclosures.

Referring to the question raised by Admiral Mills at the meeting of the Progress Control and Reports Committee concerning the width of the channel in the Puget Sound Area, Captain Smith said that an examination of hydrographic charts indicated that the channel was adequate and revealed no reason why Puget Sound should not still be considered a suitable site.

Major Burgoyne noted an inconsistency in the request for military charac-

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teristics. It was there stated that the landing and operations of medium bombers of the Mosquito type without the use of arresting gear was being considered, and that the Habbakuk had been limited to 2000 feet. He inquired if it had ever been determined that a Mosquito bomber could land within 2000 feet. He considered 4000 feet a minimum requirement. He added, however, that possibly a light bomber could be used that would reduce the length of the scale to 3000 feet.

Admiral Moreell termed this a basic point. Captain Bolster said that neither Spitfires nor medium bombers are now equipped for arrested landings nor is equipment available to arrest them. He challenged Habbakuk's practicability because of its size.

Admiral Moreell stated that discussions with the Prime Minister revealed that the first purpose conceived for Habbakuk was to protect landing operations and to combat enemy land-based aircraft.

Commodore McCall read an appreciation prepared by some of the Staff in London which said that the smaller type Habbakuk III could be very well considered because of its speed, the less time required to build it, and because operation of fighters or single-engined bombers would require no additional training or equipment. His suggestion was approved that he

Minutes Meeting 29 Oct.

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personally consult Admiral Horne and request Staff requirements from London.

Admiral Moreell said that after their first meeting Admiral Horne had felt that the Board's main purpose was to exhaust the possibilities of pykrete. Commodore McCall asked if substitution of concrete for pykrete would mean the dissolving of the subject Board. It was agreed that a change in directive would be required to resolve this situation.

Mentioned again, by both Admiral Moreell and Captain Smith, was the discouraging wood pulp situation in regard to both labor in the logging industry and the availability of pulp grinders and filters. Captain Smith said Captain Harrison had promised to send Professor McKenzie's research results on these questions.

Admiral Moreell mentioned the floating platform near completion at Daysville. He felt if the Board were to take cognizance of all Habbakuk construction they should examine this project because it is about ready to be tested. Though this one is built for a sheltered harbor and Habbakuk built for sea duty, he felt there is a definite relationship between the two. When the question of financing Habbakuk II was introduced, Admiral Moreell

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said he felt that Lend-Lease would be the easiest way because it would require no specific authorization.

The Board members agreed with Captain Merer when he said that it would seem they were now to direct their efforts toward smaller ship construction and that this would change the whole program of design and construction because the time schedule would be completely changed.

The Motion was made and carried that the monthly report be forwarded to the convening authority as read.

Captain Smith's suggestion that the Progress Control and Reports Committee meetings be held the Wednesday preceding the Board Meeting, which would be the last Friday of the month was approved.

Moved and seconded was a vote of confidence and appreciation of the energy with which the Secretary has performed his duties.

The meeting was adjourned at 1100.

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IN REPLY ADDRESS
THE BUREAU OF YARDS AND DOCKS
AND REFER TO No.
(SC)N15-5/A1-1
D-1/jw

YD Serial 01399

NAVY DEPARTMENT
BUREAU OF YARDS AND DOCKS
WASHINGTON, D. C.

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25 October 1943.

From: Chairman, Habbakuk Board.
To: Brigadier General Glen C. Jamison, USAAF.

Subject: Habbakuks - Board to Construct Section, Continue Design and Study Construction and Facilities for.

1. Meeting No. 2 of the subject Board will be held at 1000 on Friday, October 29th, in Room 3601, Navy Building.

W. H. Smith
Secretary

Major Burgoyne.
You go. I have meeting 9
M.A.C. (Air).

meetings to be held
last Friday of each month
10:00 A.M.

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NAVY DEPARTMENT
BUREAU OF YARDS AND DOCKS
WASHINGTON, D.C.

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29 October 1943.

From: Habbakuk Board.
To: Chief of Naval Operations.

Subject: Habbakuk - Board to Construct Section, Continue Design and Study Construction and Facilities for - Monthly Report No. 1.

Reference: VCNO ltr. Op-12L/fhg, (SC)LC/B13-1, Serial 0156212 of 8 October 1943.

1. As directed by reference (a), there is forwarded herewith in quadruplicate for transmittal to the Combined Chiefs of Staff, Monthly Report No. 1 covering the progress of the Board to 1 November 1943, and file copy thereof for the convening authority.

2. Attention is invited to the various communications submitted to the convening authority, copies of which are appended to the monthly report. Early classification and amplification of the directive to the Board is necessary to permit it to proceed constructively on the subject project.

3. The list of committees with their membership and functions are also appended to the monthly report. It is desired, however, that all communications relative to the subject project be addressed to the Chairman of the Board rather than to the individual committees, to avoid confusion.

B. Horeell,
Chairman.

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BOARD TO CONSTRUCT SECTION, CONTINUE DESIGN AND
STUDY CONSTRUCTION AND FACILITIES FOR HABBAKUK

MONTHLY REPORT NO. 1

NOVEMBER 1, 1943

1. The subject Board convened in the Navy Department at 1000 on 12 October 1943.

2. Five committees were appointed as follows:

(a) Planning and Program -Rear Admiral Ben Moreell,(CEC)USN-Chairman

(b) Design -Rear Admiral E.L. Cochrane, USN -Chairman

(c) Construction -Capt. A.M. Harrison, RCN -Chairman

(d) Tests -Cmdre. H.N.U. McCall,RNO,RN -Chairman

(e) Progress Control and Reports-Rear Admiral Ben Moreell,(CEC)USN-Chairman

3. The Board agreed that additional directives should be obtained from the convening authority on the time schedule for completion of its work, on the relative priority of this project and other war projects, on the scope of its functions, and on the specific military objectives and characteristics of Habbakuk II. Letter requesting these directives and outlining the Board's interpretation of the military objectives and assumptions as to military characteristics was forwarded to the convening authority on 23 October 1943.

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4. Meeting of the Planning and Program Committee was held on 28 October 1942. It was agreed that Habbakuk II could be used only in the Pacific theater, that it must therefore be built on the West Coast, that mechanical freezing of pyrete was necessary, that the trial section and prototype should be built in the same place and that Puget Sound was the most favorable site. The shortages of material, labor, and utilities in this area were discussed. The War Production Board was contacted regarding the material, machinery, manpower and utility problems and confirmed the Board's opinion that these shortages were critical with respect to a structure built of pulpwood and much less critical for a concrete structure.

5. An alternative study for a concrete Habbakuk prepared by the Bureau of Yards and Docks was presented and discussed. Preliminary studies of a schematic layout for the pyrete plant for the trial section and of the machinery and utility requirements for this plant were released. It was agreed that the convening authority should be informed immediately of the unfavorable results of the initial studies as regards critical materials, labor, power, and time required for completion of the pyrete Habbakuk. Special report on these problems was submitted to the Chief of Naval Operations by letter of October 23, 1942, recommending reconsideration of the project with a view to substituting a concrete hull for the

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pyrete structure and recommending financing from Lend-Lease funds of the initial project assigned to the subject Board.

6. By direction of the Planning and Progress Committee, the Superintending Civil Engineer, USN, for the West Coast was instructed by letter of October 23, 1943, to initiate a survey to locate possible sites in the Puget Sound area for the construction of Habbakuk II either of pyrete or of concrete, and to submit data and recommendations thereon.

7. By letter of October 28, 1943, the convening authority was requested to furnish directives regarding the relative priority of (a) the trial section, (b) one or more Pyrete Habbakuks and (c) one or more Concrete Habbakuks, as compared to the current ship and shore construction program.

8. Meeting of the Progress Control and Reports Committee was held on 27 October 1943. The form and substance of the monthly report was approved. It was agreed that this report be accompanied by copies of principal communications of the Board.

9. Monthly Report No. 1 was approved by the Board at its meeting on October 29, 1943.

Appendix "A" - Copy of letter YD 01352, Oct. 23, 1943.
Appendix "B" - Copy of letter YD 01389, Oct. 23, 1943.
Appendix "C" - Copy of letter YD 01399, Oct. 23, 1943.
Appendix "D" - Copy of letter YD 01407, Oct. 28, 1943.
Appendix "E" - Habbakuk Board Committees.

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23 October 1943.

From: Board on Habbakuks.
To: Vice Chief of Naval Operations.

Subj: Habbakuks - Board to Construct Section, Continue Design, and Study Construction and Facilities for.

Ref: (a) VCNO ltr to Rear Admiral Ben Moreell, (CEC), USN, OP-12A/fhk (SC) LC/N15-1, Serial 01562-12 of 8 October 1943.

1. Instructions are requested on the following points on which questions were raised in the meeting of the subject Board held October 12, 1943.

(a) Time Schedule.

By what date must the work of the Board be completed and final report submitted? No specific schedule was indicated in reference (a). In the meeting the British representatives indicated that prior discussions had contemplated completion of the trial section and the tests thereof by midsummer of 1944 and if these tests proved satisfactory, the completion of one Habbakuk II by midsummer 1945. It is desired that this schedule be confirmed or corrected.

(b) Scope.

Shall the Board confine itself to consideration of Habbakuk II or shall it also consider Habbakuks I and III as well as other possible alternatives. Reference (a) is specific in limiting the Board's functions to Habbakuk II. The prior documents regarding this Board likewise appear specific in this respect. The opinion was expressed by the British representatives that it was the original intention at the Quebec conference that

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[illegible] would handle all problems relating to Habbakuks of all types. Clarification of this point is desired.

(c) Military Objectives.

What specific military objectives are contemplated for Habbakuk II insofar as they determine the military characteristics of the craft? It was the consensus of opinion of the Board that before the design could be undertaken the military characteristics of Habbakuk II must be definitely specified and approved. The Board's interpretation of these objectives and a tentative specification for general military characteristics are enclosed. It is recommended that these enclosures be referred to the Combined Chiefs of Staff for approval or revision, and that their decision be furnished the Board.

B. Moreell,
Chief of Bureau.

Enclosures 1. Military Objectives.
2. Military Characteristics.

Copy: Rear Adm. E. L. Cochrane, U.S.N.

APPENDIX "A"

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ENCLOSURE I.

HABBAKUK II.

Military Objectives:

Habbakuk II shall be a mobile seagoing aircraft carrier of relatively slow speed, having a high degree of structural resistance to bombing and torpedo attack, and shall be of such dimensions that not less than 200 fighters or 100 medium bombers can be operated effectively therefrom without arresting gear or assisted takeoff.

Habbakuk II will be utilized for combat operations in the Pacific area, within enemy fighter range from hostile shores, including:

(a) furnishing fighter support to naval and amphibious operations, and
(b) bombing of enemy bases, vessels and other military targets.

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ANNEX "A" TO APPENDIX "A"

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ENCLOSURE 2.

HABBAKUK II.

Military Characteristics:

Length Overall	2,000 feet.
Beam	300 feet.
Draft	150 feet.
Freeboard	50 feet.
Displacement	1,800,000 tons.
Speed	7 knots.
Maneuverability	As practicable.
Hanger space	None.
Capacity	200 Spitfire fighters or 100 Mosquito bombers.

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Complement:		
Officers	334	
Warrant Officers	40	
CPO's	164	
Crew	2,052	
Total		2,570
Squadron shops		Equivalent to two CV's.
Other shops		Equivalent to one CV.
Operational stores		Equivalent to two CV's.
Other stores		Equivalent to one CV.
Oil		Equivalent to one CV.
Water		Equivalent to one CV.
Gasoline		Equivalent to one CV.
Armament		Equivalent to two CV's.
Magazines		Equivalent to two CV's.
Propulsion		48,000 S.H. (approximate)
Armor		None. (inherent in structural material)

ANNEX "B" TO APPENDIX "A"

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23 October 1942.

To: Superintending Civil Engineer, Area VII, Room 544, 1411 4th Avenue, Seattle 1, Wash.

Subj: Habbakuk II, Selection of Site for.

1. A special board, with Rear Admiral Ben Moreell, (CEC), U.S.N, as Chairman, has been convened at the instance of the Combined Chiefs of Staff to study a contemplated floating airdrome designated as Habbakuk II, and to construct a trial section thereof.

2. This structure will be approximately 2,000 feet long, 300 feet wide and 200 feet deep, which when completed would displace approximately 4,000,000 tons and have a draft of about 150 feet. The structural envelope will consist of frozen pulp wood, known as pykrete, 40 feet thick. Experiments conducted by British and Canadian authorities indicate that this material has adequate strength without reinforcement for the purpose.

3. The Trial Section which the board is directed to construct as soon as practicable may be of full cross section and approximately 200 feet long containing about 240,000 tons of pykrete or may be of reduced size containing about 100,000 tons of pykrete.

4. Descriptions of the construction procedure and plant contemplated and tentative requirements for the plant required for the manufacture of pykrete for both the Trial Section and the prototype are given [illegible]

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5. The board is giving consideration to an alternative seadrome of bomb resistant reinforced concrete construction which will be 2,000 feet long, 440 feet wide, and 150 feet deep which, when completed, would displace approximately 1,200,000 tons and have a draft of about 90 feet. The site requirements for the construction of a seadrome of this type are given in Enclosure 2.

6. It is requested that the Superintending Civil Engineer initiate a survey to locate possible sites in the Puget Sound area for the construction of such structures, and submit recommendations for three alternative sites for each type. It is desired that all possible information regarding the recommended sites be secured insofar as is compatible with the need for security, and transmitted to the Bureau by November 15.

H. Horsell.
Chairman, Habbakuk Board.

Encl. 1. Site Requirements for
(NS) Habbakuk II, Pykrete Construction.
2. Habbakuk II, Concrete Structure, Requirements for.
3. Sketch of Schematic Layout of Freezing Plant.
4. Plate V.

CC - Superintending Civil Engineer,
Area VII, Montgomery and Bush Streets,
San Francisco, 4, Calif.
(With above enclosures).

APPENDIX "B"

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ENCLOSURE 1

SITE REQUIREMENTS FOR HABBAKUK II, PYKRETE CONSTRUCTION

The hull of Habbakuk II will contain approximately 1,[illegible],000 tons of pykrete, a frozen mixture of 10 to 14% of mechanically ground wood pulp and 86 to 90% water. The pykrete will be frozen in large blocks possibly 12' x 9' x 9' weighing 6½ tons each. The manufacturing plant will contain cord wood storage, pulp wood grinders, screens, sliver grinders, agitated storage tanks and filters or deckers for preparing the pulp wood in lap form. The pulp lap will be delivered to flat cars inside an insulated chamber in 3/8" layers, each of which will be frozen in 20 minutes at 5°F. in air blast at 17½ miles per hour. Ninety-six recirculations of the flat cars will be necessary to build up the full thickness of the block. After the blocks are frozen, they will be transmitted to a planer to trim them to size and transported to the assembly site or to storage.

The construction procedure contemplates the assembly of the insulated bottom of the structure consisting of timber and insulation in small sections joined together, the placing thereon of the pykrete in layers in such a way as to provide an integral structure, the successive building up of the bottom and side walls with the insulation to the full depth and the placing of the pykrete deck slab. Refrigerated ducts will be built into the pykrete for maintenance of a freezing temperature throughout the structure.

The central void will be partially filled with light-weight material, possibly a mixture of pulp wood and resin in block form, with a space 65 feet wide along the center line left void for the provision of ship and flight facilities comparable in general to an aircraft carrier. It is contemplated that the Habbakuk will be equipped with propulsion for about 7 knots speed. Its displacement in operating condition will be approximately 2,200,000 tons and its draft 150 feet.

Enclosure 3 is a sketch of a schematic layout [illegible]

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based on the best information available at present. The location of the cord wood storage and pulp grinding equipment can be shifted as necessary to fit conditions at the site selected. The layout shown is the plant considered necessary for the construction of the trial section only within the time limit available. For the prototype, it is estimated that ten such units located in close proximity to each other would be necessary. These plants must necessarily be close to the construction site and have excellent access thereto.

Site Requirements. The manufacturing plant site must contain 75 to 100 acres having ten unit sites of approximately 5 acres each with reasonably level hard ground, preferably in open country, must be located favorably with respect to pulp-wood supply, must have ample transportation facilities for delivery of cord wood preferably by water or rail, and must be readily accessible to the assembly area, either by rail, conveyors, or equivalent transport methods.

Assembly Area. One or two assembly sites will be required depending upon the method of construction and hydrographic conditions. The first site must provide a well sheltered anchorage about ½ mile long and ¼ mile wide having a minimum depth of water of 40 feet, and practically free of wave action, for the assembly and construction of the initial section of the prototype. The second area must be in close proximity to the manufacturing plant, must contain the same area as the initial assembly site and must have a depth of water of at least 150 feet and preferably 180 feet. This site should be fairly well protected but not to the extent required for the initial site. A single deep water site will be preferable if it is sufficiently well sheltered.

Power Supply. It is estimated that the power requirements for the manufacture of Habbakuk II in pykrete will approach 150,000 K.W. Selection of a site with reference to available principal transmission lines is therefore of prime importance. Heavy equipment can presumably be operated on 11,000 volt or 13,200 volt circuits. Auxiliary equipment will be at lower voltages. 60-cycle, 3-phase power is assumed.

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ANNEX "A" TO APPENDIX "D"

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ENCLOSURE 1 (CONT'D)

Water Supply. Large quantities of fresh water will be required for the pulp grinding and freezing processes. It is estimated that for the prototype, total water requirements will be of the order of 300,000 gallons per minute of which possibly 90% will be recirculated and 10% will be made up. Raw water without treatment will be satisfactory. Proximity to a major source of fresh water, not affecting existing municipal sources is a major necessity.

Labor Supply. It is estimated that about 8,000 employees will be required for the construction of the prototype including the preparation of the pulp wood, freezing and transportation of blocks, construction of the hull and shipbuilding trades work.

Housing and Community Facilities. It is desirable that a site be selected in reasonably close proximity to a community capable of supplying this labor without requiring the construction of housing and community facilities. In view of the known conditions in the Puget Sound area, it is recognized that this will probably be impracticable. If such is the case a suitable housing site should be available in the immediate neighborhood of the manufacturing and assembly sites, with good access to a nearby city and with adequate municipal facilities.

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ENCLOSURE 2

HABBAKUK II, CONCRETE STRUCTURE

It is contemplated that the concrete Habbakuk shown in cross section on Enclosure 4 will be started in an enclosed basin approximately 2200' x 300' with about 30' draft over the floor. The partially completed structure will be floated from this basin at the earliest stage of completion at which it has adequate girder strength and the structure completed afloat.

Plant Site. The site selected must provide a low level area with good foundation conditions, suitable for the construction of a basin of the above dimensions, with ample space adjacent for concreting plant and shipbuilding trades facilities. The site must be near a major source of sand and gravel and be provided with ample transportation facilities for aggregates, cement, reinforcement and ship equipment.

Water Site. A deep water mooring area must be available immediately contiguous to the basin for the completion of the structure afloat. This mooring site must provide an area approximately 2200' x 400' with 100' depth of water and must provide easy access to the sea for a floating structure of this magnitude.

Power Supply. Power requirements for the concrete Habbakuk are estimated at 10,000 K.W.

Water Supply. Water requirements are estimated not to exceed 1,000,000 gallons per day.

Labor Supply. Labor requirements are estimated at 6,000 employees including

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building trades and shipbuilding trades.

Housing and Community Facilities must be available in the neighborhood or space for them must be available in close proximity to the construction site.

ANNEX "B" TO APPENDIX "BB"

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H. II Program and Problems

From: Chairman, Habbakuk Board.
To: Chief of Naval Operations.

Subj: Habbakuk II, Program and Problems.

Ref: (a) VCNO ltr to Rear Admiral Ben Moreell, (CEC), USN, file Op-12A/fhg (SC)LC/N10-1, Serial 01564K2 dated 8 October 1943.

1. The Board appointed by reference (a) has organized and begun its studies on the construction of Habbakuk II of pykrete. Technical analysis of the requirements of this project both in the preparation of the material and in the construction of the prototype has revealed problems of such magnitude and of such serious character that it is deemed advisable to call them to the attention of the convening authority for immediate consideration. These problems relate particularly to the availability of raw materials, the magnitude of manufacturing plant required, the time required to assemble this plant, and the problems of manpower procurement, power and water supply, and community facilities.

2. The Board has proceeded on the basis that the Habbakuks will be used in the Pacific Ocean and that therefore these structures must be built on the Pacific Coast of North America. No site is available on the West Coast at which the "pykrete" or frozen pulpwood blocks, of which Habbakuk II is composed, can be manufactured by natural freezing. Mechanical refrigeration is essential. The Board finds that the power required continuously for the manufacture of blocks for one Habbakuk in eight months is approximately 150,000 H.P. The only locality in which such a block of power can possibly be made available at deep water sites

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is in the Puget Sound area. New high tension transmission lines from Covington Substation, between Seattle and Tacoma, to the site would be required.

3. The shortage of manpower in the Puget Sound area is so acute that the War Production Board has taken drastic measures to prevent the further expansion of industrial facilities in this area. Furthermore, the present situation with regard to the supply of pulpwood is extremely critical due primarily to shortage of labor for cutting timber and for operating pulp mills. The War Production Board has been forced to curtail the consumption of paper and further drastic reductions are currently contemplated.

4. The requirements in the way of mechanical equipment for the manufacture of one Habbakuk within the time schedule indicated in documents made available to the committee are of huge proportions. Preliminary calculations indicate that at least 40,000 tons of special mechanical equipment will be required, much of which is of the heaviest types which cannot be procured under present conditions in less than a year. For example, thepulp grinders alone may require thirty 2500-horse power motors. Refrigeration will require 120 200-ton ammonia compressors and 120 fans each of 70,000 cubic feet per minute capacity. Over 1000 miles of 1½-inch steel pipe would be required for the cooling coils alone. A water supply with a capacity of at least 30,000,000 gallons per day would be necessary.

5. The time schedule mentioned for this project contemplates that the trial section should be complete and tests made thereon midsummer of 1944 and the full size Habbakuk completed by midsummer of 1945. The Board's preliminary studies indicate that it will be impossible to assemble the necessary mechanical equipment, provide the utilities, construct the freezing plant, and build and test the trial section in nine months or to complete the prototype within one year thereafter. The most optimistic schedule forecasts completion of the prototype in the fall of 1946.

6. Preliminary studies have been made of an alternative proposal that Habbakuk II be built of reinforced concrete. These studies indicate that a structure having

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APPENDIX "C"

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high resistance to bombing and torpedo attack can be constructed of reinforced concrete in far less time, at considerably less cost, and with lower critical material requirements than can the Habbakuk of pykrete. Construction of the prototype could be started promptly by proven methods. The progress of research and trial tests would be eliminated. A structure of concrete would have a high degree of natural permanence as compared with pykrete which is dependent for its existence on practically continuous mechanical refrigeration throughout its life. There are enclosed herewith sketch plans showing the general conception of the concrete Habbakuk. This structure is made somewhat narrower than the proposed pykrete Habbakuk, is of far shallower draft, can maintain higher speed at sea for a given horse power and permits provision of far more complete and efficient shipboard and aviation facilities.

7. No accurate estimate of relative cost of the pykrete and concrete structures has yet been made. It seems probable, however, that a total expenditure of the order of $10,000,000 will be required for the construction of the initial manufacturing plant and the construction of the trial section of Habbakuk II which the Board is directed by its precept to undertake immediately. The prototype will probably cost in the neighborhood of $50,000,000 for the bare hull to which must be added all mechanical equipment and shipboard and aviation facilities to be provided. The concrete Habbakuk is visualized as costing in the neighborhood of $30,000,000 for the bare hull plus $50,000,000 to $70,000,000 for the equipment and facilities, based upon full utilization of the vast internal space available in this structure.

8. In view of the large expenditures necessary in connection with the construction of the trial section, it is recommended that arrangements be effected for financing

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directed by reference (a).

9. It is strongly recommended that the Combined Chiefs of Staff be informed of the seriousness of the problems involved in constructing Habbakuk II of ice and that the project be reconsidered with a view to the substitution of a concrete structure along the general lines indicated by the enclosed sketch plans.

B. Morsell,
Chief of Bureau.

Encl.
1. Sketch plans of Concrete Habbakuk.
(6 prints)

APPENDIX "C" (PAGE 2)

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(SC)N15-3/A1-1
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YD Serial 01407

SECRET

28 October 1943.

From: Board on Habbakuks.
To: Chief of Naval Operations.

Subject: Habbakuks - Board to Construct Section, Continue Design and Study Construction and Facilities for.

Reference: (a) VCNO ltr. to Rear Admiral Ben Moreell (CEC) USN, Op-12A/fhg, (SC)LC/N10-1, Serial 0156212 of 8 October 1943.

1. It is requested that the subject Board be informed of the priority of the project for Habbakuks in relation to other projects now underway or contemplated.

2. It is apparent that the construction of the trial section of Habbakuk II of pykrete will involve the procurement of a considerable quantity of heavy machinery and electrical equipment, which will conflict with current procurement programs of high priority. The production of raw materials and the manufacturing processes will necessitate the diversion of considerable specially qualified manpower in critically short industries. This diversion can be accomplished only by assigning this project priorities above much of the current program.

3. The subsequent construction and outfitting of one or more Habbakuks of pykrete, if undertaken, will multiply these requirements tenfold, and in addition will impose requirements for shipboard equipment conflicting directly with the present combatant ship program. The substitution of concrete hulls would alleviate the

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situation as regards raw materials and special hull production labor, but would increase the requirements for shipboard equipment because of the vastly greater scope of facilities which can and would be installed in the concrete hull.

4. The present combatant ship program is classified AA-1, with relative urgency defined by special directives, by the Group Precedence List and by the Basic Priority Directive. The Advance Base Program, and a small part of the Navy shore construction program are likewise AA-1.

5. The priority and relative precedence should be established for:

(a) The trial section of Pykrete Habbakuk II;
(b) One or more full size, completely equipped Pykrete Habbakuk II, if undertaken;
(c) One or more full size, completely equipped concrete Habbakuk II, if undertaken.

B. MORELL.

APPENDIX "D"

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HABBAKUK BOARD
PROGRESS CONTROL AND REPORTS COMMITTEE
MINUTES OF MEETING NO. 1, 27 OCTOBER 1943

The Committee met at 1000 in Room 2052, Navy Building.

Present:

Rear Admiral Ben Moreell (CEC) USN.	Chairman
Capt. W. R. Smith (CEC) USN.	Secretary and Deputy
Rear Admiral Earle W. Mills, USN.	
Capt. Earl F. Enright, USN.	
Group Capt. S.W.F. Horer, RAF.	Deputy

Minutes Meeting 27 Oct.

Stating that the main business before the Committee was to prepare a monthly report to the convening authority, Admiral Moreell read the preliminary draft report prepared by the Secretary.

He said that a letter concerning priorities was being sent to the convening authority to determine where the Habbakuk project fits in with the priorities of other construction such as combatant ships and advance bases which have AA1 priority, and continental construction which is allowed AA1 priority amounting to $10,000,000 per quarter.

Admiral Moreell stated that the pulp situation is critical, due primarily to lack of labor in the logging industry.

When told by the Chairman that the draft of the Habbakuk was to be 150 feet in pykrete or 90 feet in concrete, Rear Admiral Mills felt that Puget Sound should be

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more fully investigated as a suitable site because of the entrance shoals. He thought a wider channel would be necessary to maneuver the craft.

Admiral Morsell asked for comments on the preliminary report but there were none. He proposed that there be attached to the final report to the convening authority the names and detailed functions of the Habbakuk Board Committees and all communications sent the convening authority by the Board. He considered this valuable because complete reports will be forwarded to the Combined Chiefs of Staff who can then readily see that the Board is at a virtual standstill until it receives more necessary information.

Approving of this procedure, Admiral Mills stated that to avoid confusion, an additional paragraph should stipulate that all communications be addressed to the Chairman of the Board rather than to the individual committees.

Capt. Smith, however, cautioned that care should be taken not to create the impression that the Combined Chiefs of Staff contact the Board and by-pass the VCNO. Also, he felt that the function of the Construction Committee which has as yet had no meeting, should be discussed.

Admiral Morsell considered this impossible because of the absence of Capt. Harrison, the Committee chairman. He wondered, too, whether it was worthwhile holding any meeting until answers to their questions had been received.

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Rear Admiral Mills reminded the committee members that requests have been received for the speedy delivery of a great number of transports. This program calls for so much material that it is important to have a proper perspective regarding manpower, priorities, etc., for Habbakuk II.

Admiral Mills stated that overall priority directives come from the Joint Chiefs of Staff Committee through the VCNO and Joint Army and Navy Priorities Committee and that a group precedence list is obtainable. He felt that the latest priority directive should be made available to Capt. Smith.

Capt. Merer inquired if the board had been given staff requirements to follow and was shown a copy of the letter sent the convening authority requesting them.

Capt. Smith said that the Pulp and Paper Division, War Production Board, had confirmed approximately his figures on power requirements and his tentative selection of equipment for pulp manufacture for the Habbakuk construction. Admiral Horsall mentioned it would take five times the power of the Philadelphia Navy Yard to assemble this project, not to work it.

The meeting was adjourned at 1045.

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Adm. Nimitz wants draft of report of Progress Council to Reports.

only in Brief.

Project moved

Critical shortage material programs and power.

Kaiser concrete ships.

Last Friday of each month.

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D-1/jw
Serial YD 01391

NAVY DEPARTMENT
BUREAU OF YARDS AND DOCKS
WASHINGTON, D. C.

SECRET

21 October 1943.

From: Chairman, Habbakuk Board.
To: Brigadier General Glen C. Jamison, USAAF.

Subject: Habbakuks.

1. Forwarded herewith are enclosures (1), (1a), (2), (3) and (4) for your information and retention.

W. H. Smith
Secretary

Encl. 1. (SC)N15-5/A1-1, D-1, Serial YD 01380, 20 October 1943, Memorandum to Habbakuk Board, Pykrete Plant.
1a. Schematic layout of freezing plant.
2. (SC)N15-5/A1-1, D-1, Serial YD 01382, 20 October 1943, Memorandum to Habbakuk Board, Trial Plant, Electric Motor Requirements.
3. (SC)N15-5/A1-1, D-1, Serial YD 01390, 21 October 1943, Memorandum to Habbakuk Board, British Experts.
4. N15-5/A1-1, D-1, No. YD_HA2, Minutes of Meeting of Planning and Program Committee, 20 October 1943.

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Serial YD 01380

NAVY DEPARTMENT
BUREAU OF YARDS AND DOCKS
WASHINGTON, D.C.

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20 October 1943.

MEMORANDUM TO HABBAKUK BOARD:

Subj: Habbakuk II - Pykrete Plant.

Pykrete Plant

1. In order to obtain an approximate idea of the equipment and plant layout required for the manufacture of pykrete for both the Trial Section and prototype of Habbakuk II, a schematic plant layout as shown on the enclosure has been prepared based on the meager information available at present.

2. The Trial Section if made full scale in cross section and 200' long with the ends made 40' thick would require 242,000 tons of pykrete. The amount of equipment required for this quantity is so large that this study has been based arbitrarily on reducing the Trial Section to 100,000 tons, which it has been assumed, must be cast in 100 days. The plant must therefore have a capacity of 1,000 tons per day.

3. Production problems seem to dictate a multiple production line layout, each line having a capacity fixed by the largest pulp lap equipment available. The British studies contemplated the use of 50 ton per day machines. The layout sketch has been based upon 100 tons per day per unit. It is believed that this is reasonable since the 50 ton per day rating of paper making machines is believed to be based on dry paper and if the weight is based on 14% pulp plus 86% water, the output of such machines would apparently be 350 tons per day. If the latter output can be approached, fewer lines, each longer and serviced with larger fans and refrigerating plant, would be indicated;

4. The process would involve the following basic steps.

(a) Cord wood would be stacked in a large storage area equipped with lateral conveyors feeding onto a main line belt.

(b) The cord wood would be delivered by this belt to mechanical pulp grinding machines which would reduce the wood to fiber and mix it with water.

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(c) From the grinder the slurry would pass over screens which would extract the large unground material which would pass into a separate receptacle from which it would be pumped or otherwise conveyed back into the grinder for recirculation, or into a sliver grinder.

(d) The slurry after passing through the screen would drop into a separate receptacle from which it would be pumped to storage tanks equipped with mechanical agitators. These tanks may be elevated so that flow from them to the freezing plant is by gravity or it may be preferable to place them at or below ground level and rehandle the material through additional pumps. The slurry at this stage is possibly 97 or 98% water and 2 or 3% pulp.

(e) The slurry is pumped from these storage tanks to the lap forming equipment. This consists of a filter vat or "decker" in which the slurry is picked up on a circular screen and water extracted from the forming lap by vacuum maintained within the cylindrical screen. The material is then stripped off the circular screen and passes on to a conveyor.

(f) The lap is then passed by conveyor to a continuous string of flat cars situated in an insulated freezing chamber. The scheme indicated shows two parallel tracks each holding ten cars in line with transfer tracks at either end for continuous circulation. Alternative schemes present themselves as possibilities. A continuous conveyor with the outgoing cars placed above the returning cars might be evolved which would be advantageous in reducing the cross section of the freezing tunnel.

5. Refrigeration and ventilation is provided by introducing a blast of cold air at the far end of the tunnel, the blast being against the direction of travel of the cars, with balanced atmospheric pressure maintained at the lap conveyor entrance to minimize air leakage.

6. When the blocks of pykrete are built up to full thickness, the cars pass out of the freezing tunnel through the airlock at the end at which the pulp is received and the blocks are planed to accurate dimensions and transported to the assembly area.

7. To date no definite size of block has been determined as most advantageous. The layout sketched has been based on the assumption that 20 cars would be provided, each carrying a block which would be built up to 12'x6'x3' weighing approximately 6.5 tons with air at 5°F. at 17.5 miles per hour velocity. Each 3/8" layer would be frozen in 20 minutes requiring 96 passes of the cars in 32 hours. The weight of pykrete per pass per block would be approximately 135# and the total weight per hour of pykrete frozen would be 8100#. The capacity of the unit

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would be 100 tons of pykrete per day. The cars would travel at 12' per minute net or about 15' per minute allowing for delays at the transfer tracks. The net length of tunnel would be 120' plus about 30' at either end making a total of 180'.

8. Maintenance of air velocity in the tunnel would require a fan of roughly 70,000 cubic feet for each unit, operating against a head of 3" of water, requiring a 50 horse power motor. The refrigeration would be accomplished by passing this air through cooling coils of plain pipe located in the discharge from the fans and possibly also in the suction intakes. These coils would be continuously defrosted by passing concentrated brine having a freezing point below the air temperature. To maintain 5°F. of the air blast, refrigeration will probably have to be at -15 or -20°F. to provide sufficient differential and to reduce the amount of coil pipe. Assuming condensing water at 60°F., a refrigeration compressor of 200 tons rating equipped with a 300 horse power motor will probably be necessary. In lieu of separate compressors for each unit, a smaller number of large compressors may prove practicable.

9. For the production rate contemplated, ten of these production lines will be required plus two spares or a total of twelve.

10. Until more definite information is obtained as to commercial equipment available and more accurate studies of the capacities required in the various elements for balanced production, only a crude guess can be made as to the equipment required and the machinery weights. These tentative requirements are summarized below:

(a) Lateral conveyor in cord wood storage yard, 8 belt conveyors, 24"x200'.
(b) Trunk conveyor, storage yard to grinders, one belt conveyor, 36" x 400', with three trippers.
(c) Apron conveyors to grinders, three 24" x 40'.
(d) Grinders, three at 50 tons per day dry wood capacity or equivalent, with screens and slurry and sliver vats.
(e) Grinder supply pumps, three at 3000 g.p.m. capacity, 15 horse power motors.
(f) Slurry pumps, three at 5000 g.p.m. capacity, 25 horse power motors.
(g) Three slurry storage vats at 100,000 gal. capacity equipped with mechanical agitators.
(h) Supply pumps, three at 5000 g.p.m. capacity (may be eliminated if storage vats are elevated).
(i) Deckers, twelve at 100 tons per day, 14% pulp.

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(j) Pulp lap conveyors, twelve 6'x40' belt conveyors.
(k) Freezing tunnels, twelve 8' wide, 6'-6" high, twin tube insulated, 180' long with tracks and two transfer cars each.
(l) Pykrete block cars, 240 active freezing cars plus 60 for exterior transit, total--300.
(m) Fans, twelve at 70,000 c.f.m. at 3" water pressure, 50 horse power motor.
(n) Refrigeration compressors, twelve at 200 tons per day, 300 horse power motor, or equivalent.
(o) Cooling coils, twelve at 6' x 18' x 20' each containing 10,000 square feet of heat transfer surface, equipped with continuous brine defroster.
(p) Brine system, twelve brine pumps, 500 g.p.m. with storage tanks and brine coolers.
(q) Circulating pumps, twelve at 1000 g.p.m. (or 24 at 500 g.p.m.)
(r) Planers, two of 100 block per day capacity or equivalent.
(s) Locomotives, two for external haulage.
(t) Cranes, one for cord wood storage, one locomotive or bridge type for handling blocks at planer.

11. For the prototype, 1,800,000 tons of pykrete blocks will be required. If it is assumed that this quantity must be produced in 180 days, a capacity of 10,000 tons per day will be required. Ten of the foregoing installations would be necessary. Each plant would require a total area of approximately 240,000 square feet or say five acres. The prototype plant would require from 50 to 75 acres depending on the dispersion of the ten individual plants.

12. The total weight of equipment required for the trial plant is estimated at 4000 tons. The total required for the prototype plant is estimated at 40,000 tons.

W. H. Smith
Secretary

Encl.
1. (HW) Schematic layout of freezing plant.

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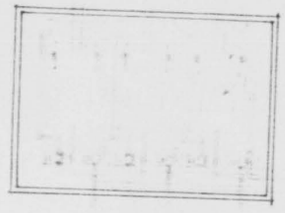

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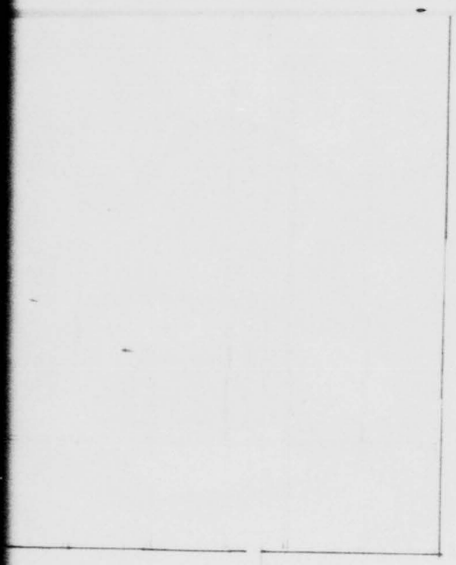

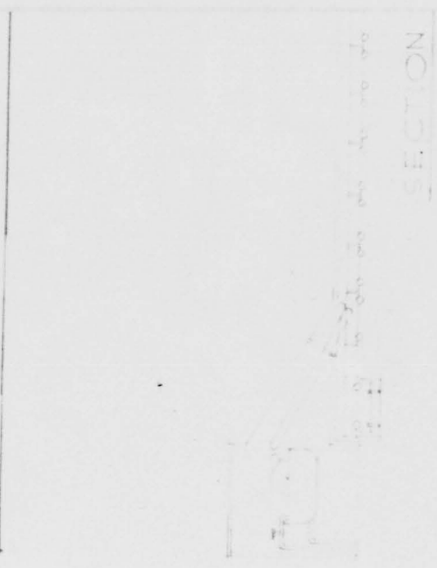

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SCHEMATIC LAYOUT
OF
FREEZING PLANT

OCT. 1943

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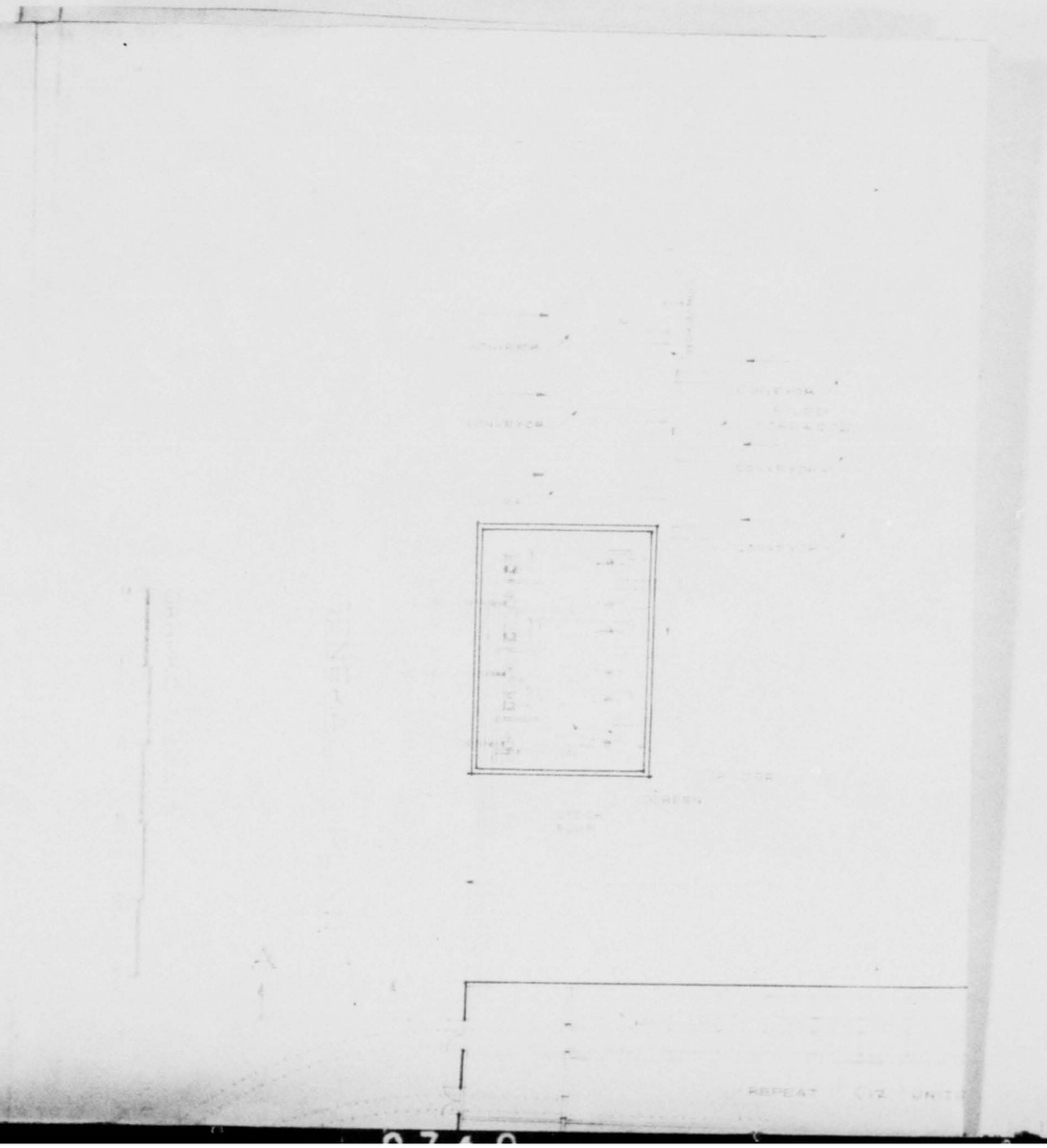

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YD Serial 01382

NAVY DEPARTMENT
BUREAU OF YARDS AND DOCKS
WASHINGTON, D.C.

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20 October 1943.

MEMORANDUM TO HABBAKUK BOARD:

Subj: Habbakuk II - Trial Plant, Electric Motor Requirements.

1. Based on the tentative schematic layout, the motor requirements for the pulp preparation and freezing plant for the Trial Section of Habbakuk II will amount to approximately 15,000 horse power as summarized in the following table.

3 Grinders	@ 2500 H.P.	7500 H.P.
6 Pumps	@ 30 H.P.	180 H.P.
13 Conveyors	@ 10 H.P.	130 H.P.
3 Agitators	@ 20 H.P.	60 H.P.
12 Deckers	@ 100 H.P.	1200 H.P.
12 Conveyors	@ 5 H.P.	60 H.P.
24 Cable systems	@ 30 H.P.	720 H.P.
12 Fans	@ 50 H.P.	600 H.P.
12 Refrig. machines	@ 300 H.P.	3600 H.P.
24 Circ. pumps	@ 10 H.P.	240 H.P.
12 Brine pumps	@ 10 H.P.	120 H.P.
Misc. machinery (screens, etc.)		200 H.P.
		14,610 H.P.

Trial Plant - Electric Motors

W. H. Smith
Secretary

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YD Serial 01390

NAVY DEPARTMENT
BUREAU OF YARDS AND DOCKS
WASHINGTON, D.C.

SECRET

21 October 1943.

MEMORANDUM TO HABBAKUK BOARD:

Subj: British Experts.

1. Forwarded herewith are the names and particular talents of the British experts who are now in Washington and available for the planning and construction of HABBAKUK II:

Mr. J. W. Rivett - Planning and Construction. A.R.I.A., A.S.I.N.A., A.R.V.I.A. Structural cost and program.

Dr. M. F. Perutz - Scientific Research. Production and technical use of pykrete; Testing of pykrete.

Mr. E. S. Green - Refrigeration Engineering. Production and practical use of concrete; Maintenance of pykrete.

Mr. R. W. Wright - Naval Arch. and Marine Eng. Structural Design.

British Experts

W. H. Smith
Secretary

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HABBAKUK II

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COMMITTEE A - PLANNING AND PROGRAM COMMITTEE

MINUTES OF MEETING NO. 1, 20 OCTOBER 1943.

The committee convened at 1000 in Room 2022, Navy Building.

Present:

Rear Admiral Ben Moreell (CEC) USN	Chairman
Capt. William H. Smith (CEC) USN	Deputy and Secretary
Rear Admiral DeWitt C. Ramsey, USN	Member
Capt. Calvin M. Bolster, USN	Deputy
Air Vice Marshal G.V. Walsh, MBE, RCAF	Member

The chairman examined sketches of an alternative to HABBAKUK II bomb-resistant reinforced concrete construction, and schematic layout plans for the Pykrete freezing plant; he then read a memorandum from the Secretary concerning the proposed plant and machinery for the trial section.

It was agreed that both the trial section and prototype of HABBAKUK II should be built in the same place. This factor, plus the availability of pulp and deep water, made Puget Sound appear to be the most favorable site.

The chairman's suggestion was approved. It was agreed that because the

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West Coast presents a shortage of utilities, resources and trained labor, the committee should know with more certainty where and how these necessities are to be acquired; that a letter should be sent the convening authority saying the project is advancing as rapidly as possible but these scarcity characteristics must be considered. Captain Smith mentioned the supply of power and the number of pulp mills in the Puget Sound area but stressed the need for skilled labor.

The chairman suggested that Captain Smith contact the War Production Board concerning the manufacture of pulp and availability of grinders, and the War Manpower Commission to discuss labor problems. He also stated that a letter to the convening authority had been prepared concerning the questions raised at the 12 October 1943 Habbakuk Board Meeting -- those of the time schedule, whether to consider Habbakuk II only, military characteristics, and priorities. Captain Smith stated that the draft of this letter had been sent to Rear Admiral Cochrane for review.

It was agreed that action should be taken immediately to select a suitable site. Consideration was given to ordering Rear Admiral Bruns,

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Superintending Civil Engineer for the West Coast, to the Bureau for discussion, but it was agreed preferable for Captain Smith to visit the sites tentatively selected.

The chairman asked that Captain Smith write up specifications on the characteristics of the site and an outline of the refrigeration plant; also, that he contact Mr. Rivett concerning the plans for machinery and the plant outline.

The committee members were asked by the chairman if they felt possibly an outside engineering firm should be engaged to do the work. It was decided that this not be considered until a comparative study on Pykrete and concrete Habbakuks had been submitted to the convening authority.

The committee voted to write the Chief of Naval Operations a letter concerning this comparative study, requesting that the entire matter be referred back to the Combined Chiefs of Staff. The Study is to discuss in detail the features of concrete as compared with pykrete, and the comparative ability of each to take punishment. Included in the letter should be mentioned the questions of availability of manpower,

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equipment and materials, and of a time schedule.

It was further agreed that while waiting for the decision from the convening authority concerning the matter, the committee should work on developing specifications for the site, selecting that site, and starting work on it.

The meeting was adjourned at 1115.

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YD Serial 01374

NAVY DEPARTMENT
BUREAU OF YARDS AND DOCKS
WASHINGTON, D. C.

18 October 1943.

SECRET

From: Chairman, Habbakuk Board.
To: Brig. Gen. Glen C. Jamison, USAAF.

Subject: Habbakuks - Board to Construct Section, Continue Design, and Study Construction and Facilities for.

1. Enclosures (1) and (2) are forwarded herewith for your information and retention.

W.H. Smith
Secretary

Enclosures: 1. Habbakuk Board Committees, N15-5/A-1, YD-HA1.

2. Chief of Naval Operations Letter to Chairman, Board on Habbakuks Op-12-A/bb, (SC)LC/N10-1, Doc. 96707, Ser. 0165112, of 16 Oct. 1943.

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No. YD-HA1

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HARBAZUK BOARD

COMMITTEES

A. Planning and Program.

Functions: To select the site for the construction of the trial section, and for the prototype if its construction is authorized; to handle all matters relating to allocation of materials, allocation of construction equipment, provisions for construction and administrative personnel, provisions for housing, messing and welfare of personnel, obtaining power supply and other utilities, and obtaining priorities for equipment, materials and manpower; to handle all matters relating to cost estimates and financing of the project.

Chairman: Rear Admiral Ben Moreell (CEC) USN.

Members: Rear Admiral Dewitt C. Ramsey, USN.

Air Vice Marshal G. V. Walsh, MBE, RCAF.

B. Design.

Functions: To determine and submit to the Board for approval by the appropriate agencies the primary characteristics and re-

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quirements of the trial section and prototype; to study all matters pertaining to design of the trial section and prototype, based on the approved characteristics; to prepare tentative outline directive to the design agency for the consideration of the Board; to prepare schematic plans of the prototype for review, approval and transmittal to the convening authority; to act as consultants in connection with the preparation of plans and specifications when undertaken.

Chairman: Rear Admiral Edward L. Cochrane, USN.

Members: Rear Admiral Ben Moreell (CEC) USN.

Mr. J. W. Rivett.

C. Construction.

Functions: To handle all matters pertaining to the construction of the trial section and prototype; to prepare schedules for construction program; to supervise construction and inspection of work.

Chairman: Construction Captain A. H. Harrison, RCN.

Members: Rear Admiral E. L. Cochrane, USN.

Mr. J. W. Rivett.

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D. Tests.

Functions: To prepare programs for tests of materials, processes and procedures, and for tests of the trial section; to conduct tests; to prepare reports thereon with conclusions and recommendations.

Chairman: Commodore H.W.U. McCall, RN.

Members: Air Vice Marshal G. V. Walsh, MBE, RCAF.

Brigadier General G. C. Jamison, USAAF.

E. Progress Control and Reports.

Functions: To coordinate the work of the other committees; to determine procedure; to resolve problems of cognizance, liaison and correlation; to review reports of other committees; to prepare summary reports and recommendations for transmittal by the Board to the convening authority; to prepare the monthly report for the Combined Chiefs of Staff as required by the Board's precept.

Chairman: Rear Admiral Ben Moreell (CEC) USN.

Members: Rear Admiral Edward L. Cochrane, USN.

Commodore H.W.U. McCall, RN.

Construction Captain A. N. Harrison, RCN.

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NAVY DEPARTMENT
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
WASHINGTON

Op-12-A/bb
(SC)LC/N10-1
Doc. 96707
Ser. 0165112

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16 October 1943.

From: Chief of Naval Operations.
To: Chairman, Board on Habbakuks.

Subject: Habbakuks - Board to Construct Section, Continue Design, and Study Construction and Facilities for.

Reference: (a) Board on Habbakuks secret ltr. file (SC)N10-3/ A1-1, D-1, YD Serial 01353, dated 14 October 1943 to VCNO.

1. Reference (a) states that at the initial meeting of the subject board on October 12, 1943, Commodore H.W.U. McCall, RN, Member, requested that Group Captain J.W.F. Merer, RAF, be designated as his deputy on the subject board vice Captain H. D. Tollemache, RN.

2. In view of the above, Group Captain J.W.F. Merer, RAF, is hereby designated as the deputy for Commodore H.W.U. McCall, RN, vice Captain H.D. Tollemache, RN.

/s/ F. J. Horne

Vice Chief of Naval Operations

Letter from Chief Naval Operations

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IN REPLY ADDRESS
THE BUREAU OF YARDS AND DOCKS
AND REFER TO No.
(SC)N15-5/A1-1
D-1/jw

YD Serial 01365

NAVY DEPARTMENT

BUREAU OF YARDS AND DOCKS

WASHINGTON, D. C.

SECRET-SECURITY

16 October 1943.

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From: Chairman, Habbakuk Board.
To: Brigadier General Glen C. Jamison, USAAF.

Subject: Habbakuks.

1. Enclosures (1) and (2) are forwarded herewith for information and retention.

W. H. Smith
Secretary

Enclosures: (1) Secret-Security J.AD.C.60/D of 21 August 1943, Joint Administrative Committee Directive on Habbakuk. Copy No. 37-A3.

(2) Secret-Security C.C.S. 112th Meeting, 19 August 1943, Combined Chiefs of Staff Quadrant Conference. Copy No. 26-A3.

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J.AD.C. 60/D

21 August 1943

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COPY NO. 37-A3

(LIMITED DISTRIBUTION)

JOINT ADMINISTRATIVE COMMITTEE

DIRECTIVE

HABBAKUK

References: a. C.C.S. 315; C.C.S. 315/1.
b. C.C.S. 112th Meeting, Item 3.
c. J.C.S. memo. directive, 21 August 1943.

Note by the Secretaries

1. In accordance with a suggestion made by the Joint Staff Planners, the Joint Chiefs of Staff desire that the Joint Admini-

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J.AD.C. 60/D

21 August 1943

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JOINT ADMINISTRATIVE COMMITTEE

DIRECTIVE

HABBAKUK

References: a. C.C.S. 315; C.C.S. 315/1.
b. C.C.S. 112th Meeting, Item 3.
c. J.C.S. memo. directive, 21 August 1943.

Note by the Secretaries

1. In accordance with a suggestion made by the Joint Staff Planners, the Joint Chiefs of Staff desire that the Joint

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strative Committee submit recommendations as to how paragraph c under the conclusions of Item 3 of the 112th C.C.S. meeting should be implemented.

Director Joint Adm Committee

2. Enclosure is a memorandum from the Joint Staff Planners to the Joint Chiefs of Staff on the subject, dated 20 August 1943.

A. J. McFARLAND,
C. B. GARY,
Joint Secretariat.

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ENCLOSURE

20 August 1943

MEMORANDUM FOR - Secretary, U.S. Joint Chiefs of Staff.

Subject: Implementation of Decision of the Combined Chiefs of Staff Relative to HABBAKUK II.

1. In the 112th C.C.S. meeting the Combined Chiefs of Staff took the following action under Item 3:

"a. Took note of paragraphs a, b, and c of C.C. S. 315/1.

"b. Agreed to the construction of a section of HABBAKUK II, the continuation of design, and the study of the construction and of the facilities necessary for a full size ship. This agreement to be incorporated as paragraph d in C.C.S. 315/1.

"c. Agreed that the appropriate United States, British

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and Canadian authorities should be invited to set up a Board forthwith to press on with the action agreed in b above, and to report progress monthly to the Combined Chiefs of Staff."

2. The Joint Staff Planners recommend that the Joint Administrative Committee be directed to recommend to the Joint Chiefs of Staff the method of implementation of paragraph c of the above quoted decision.

A.J. McFARLAND,
Secretary,
Joint Staff Planners.

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C.C.S. 112th Meeting

19 August 1943

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(LIMITED DISTRIBUTION)

COMBINED CHIEFS OF STAFF

QUADRANT CONFERENCE

Minutes of Meeting held in Room 2208, Chateau Frontenac Hotel, on Thursday, 19 August 1943, at 1430.

PRESENT

General G. C. Marshall, USA
Admiral E. J. King, USN
General H. H. Arnold, USA

General Sir Alan Brooke
Admiral of the Fleet Sir Dudley Pound
Air Chief Marshal Sir Charles Portal

ALSO PRESENT

Rear Adm. C. M. Cooke, Jr., USN

Vice Admiral Lord Louis Mountbatten

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Rear Adm. O. C. Badger, USN
Brig. Gen. L. S. Kuter, USA
Brig. Gen. A. C. Wedemeyer, USA
Commander V. D. Long, USN

Lt. Gen. Sir Hastings L. Ismay
Brigadier W. Porter
Brigadier M. W. M. Macleod
Captain L. E. Porter, R.N.
Air Commodore B. Warburton
Professor Bernal
(For part of Item 5)

Minutes Quadrant Conference

PRESENT FOR ITEMS 5, 6 AND 7

Lt. Gen. B. B. Somervell, USA
Vice Adm. R. Willson, USN
Maj. Gen. T. T. Handy, USA
Maj. Gen. M. S. Fairchild, USA

Field Marshal Sir John Dill
Gen. Sir Thomas Riddell-Webster
Admiral Sir Percy Noble
Lt. Gen. G. N. Macready
Air Marshal Sir R. Welsh

SECRETARIAT

Brigadier H. Redman
Brig. Gen. J. R. Deane, USA
Capt. F. B. Royal, USN
Comdr. R. D. Coleridge

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1. CONCLUSION OF THE PREVIOUS MEETING

THE COMBINED CHIEFS OF STAFF: -

Accepted the conclusions of the 111th Meeting. The detailed record of the meeting was also accepted, subject to minor amendments.

2. PROGRESS REPORT TO THE PRESIDENT AND PRIME MINISTER

THE COMBINED CHIEFS OF STAFF had before them a draft progress report to the President and Prime Minister.

THE COMBINED CHIEFS OF STAFF: -

Approved the Progress Report to the President and Prime Minister.

3. HABBAKUKS
(C.C.S. 315 - 315/1)

LORD LOUIS MOUNTBATTEN said that HABBAKUKS might be regarded as floating seadromes or giant aircraft carriers. They could be used as floating advance landing grounds and could form a staging base for air attacks. They might ultimately be used for four-engined heavy bombers. He outlined the principal characteristics of the three types. He then referred to pykrete, the material from which it was proposed to construct HABBAKUK II. This might prove a strategic material of which [illegible] It was formed of a frozen mixture of

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there was an abundant supply. [illegible] diluted pulp and water, the latest type of which contained 94 per cent water. He gave details of the characteristics and strength of this material. A thousand ton model had been built and had spent the summer in Lake Jasper, refrigeration being maintained by means of an engine of only 15 horsepower. He wished to emphasize that a HABBAKUK II, constructed of pykrete, had no limit to its size. Four-engined bombers could use them if they were built of sufficient dimensions or if adequate arrester gear and assisted take-off could be arranged.

SIR CHARLES PORTAL said that the British Chiefs of Staff regarded HABBAKUK II as essentially a Pacific project. General Arnold had mentioned the difficulty of providing adequate bases in the Islands for the deployment of air forces for the bombardment of Japan. It would be a long time before the supply route to China allowed the maintenance of large air forces in that country and therefore the HABBAKUKS might be regarded as strategic bases or staging points for air attacks against Japan and would thus fill a gap in our facilities. They could be provided without impinging on other programs.

ADMIRAL KING said that he would agree to accept the recommendations contained in paragraph 8 b of C.C.S. 315.

In reply to a question by General Arnold, LORD LOUIS MOUNTBATTEN said that it was proposed that experiments and construction of pykrete sections for HABBAKUK II should proceed during the coming winter. If these experiments proved successful, construction could start in the Spring of 1944 and the completed HABBAKUK be ready by the Spring of 1945. In the meanwhile no delay must occur in the preparation of plans and construction of sites for the building of the HABBAKUKS. He asked that the

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Combined Chiefs of Staff should also approve the setting up of a U.S.-British-Canadian Board to press on with the whole matter, not only with regard to the winter experiments and the preparation of sites, but also with the preparation of drawings for the completed HABBAKUK. This Board should, in order to insure results, be asked to report monthly to the Combined Chiefs of Staff.

PROFESSOR BERNAL demonstrated with the aid of samples of pykrete the various qualities of this material.

THE COMBINED CHIEFS OF STAFF: -

a. Took note of paragraphs a, b, and c of C.C.S. 315/1.

b. Agreed to the construction of a section of HABBAKUK II, the continuation of design, and the study of the construction and of the facilities necessary for a full-size ship. This agreement to be incorporated as paragraph d in C.C.S. 315/1.

c. Agreed that the appropriate United States, British and Canadian authorities should be invited to set up a Board forthwith to press on with the action agreed in b above, and to report progress monthly to the Combined Chiefs of Staff.

4. LANDING CRAFT

a. Manning of Landing Craft
(C.C.S. 286/3)

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THE COMBINED CHIEFS OF STAFF: -

Agreed to the modified proposal put forward by the British Chiefs of Staff in paragraph 2 of C.C.S. 286/3.

b. Allocation of Landing Craft - Operation OVERLORD - Vehicle Lift (C.C.S. 314)

THE COMBINED CHIEFS OF STAFF:-

Agreed with the proposal of the British Chiefs of Staff in paragraph 4 of C.C.S. 314 that the possibility of arranging an increase in the number of LCT(6) available for OVERLORD from American sources should be explored.

c. Allocation of Landing Ships and Craft - American Production (C.C.S. 314/1 - 314/2)

LORD LOUIS MOUNTBATTEN explained that under the present ruling the Combined Munitions Assignments Board would feel themselves bound to allocate landing craft only to specifically projected operations. In order that the British should be able to play their part in operations in the Pacific, it was necessary for them to enter and train adequate personnel to man landing craft. If the present ruling were followed landing craft could be only allocated for specifically agreed operations which at present did not exist in the Pacific Theater. The British assault

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force which was in fact available and used for Operations TORCH and HUSKY had of necessity been built up before these actual operations were decided on. He felt that the allocation of landing craft should be based on agreed strategy rather than on agreed operations.

GENERAL MARSHALL said that the present position was such that there was everywhere a deficit of landing craft. Our operations were limited in many cases solely by the lack of these vessels. In view of this over-all deficiency, he felt it essential to retain the ruling that landing craft should be allocated only to specifically agreed operations.

ADMIRAL KING said he would like to know the future construction program for landing craft in the United Kingdom. He appreciated the necessity for the provision of landing craft for training purposes.

ADMIRAL KING then suggested a modification to proposal 3 b, in C.C.S. 314/1, designed to meet Lord Louis Mountbatten's point.

THE COMBINED CHIEFS OF STAFF:-

Approved paragraph 3 b of the enclosure to C.C.S. 314/1 modified to read as follows:

"That the British should now work out their

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training requirements and submit requests for a corresponding share of U.S. production in 1944-45."

5. USE OF "PLOUGH" FORCE
(C.C.S. 316)

GENERAL MARSHALL said that the U.S. Chiefs of Staff agreed with the proposal that the capabilities of the PLOUGH force should be communicated to General Eisenhower and General Morgan who should be asked to report to the Combined Chiefs of Staff whether these forces could be usefully employed in their theaters. This force had already been ordered to withdraw from Kiska.

LORD LOUIS MOUNTBATTEN suggested that it would assist the two commanders if a United States officer from PLOUGH force could proceed to the two theaters to give details of the capabilities of the force. He himself could also send an officer.

THE COMBINED CHIEFS OF STAFF:-

a. Took note that Admiral Nimitz and General DeWitt had been directed to return the PLOUGH force to the United States on the first available transportation.

b. Concurred in the proposal presented in paragraph 4 of the enclosure to C.C.S. 316.

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6. EQUIPPING ALLIES, LIBERATED FORCES AND FRIENDLY NEUTRALS (C.C.S. 317)

SIR ALAN BROOKE said that the British Chiefs of Staff had not yet had time to consider this paper.

GENERAL MARSHALL put forward certain amendments to the paper, which were suggested by the U.S. Chiefs of Staff.

THE COMBINED CHIEFS OF STAFF:-

a. Took note of certain amendments presented by the U.S. Chiefs of Staff.

b. Agreed to defer action on the paper until the next meeting.

7. SPECIAL OPERATIONS IN SARDINIA

GENERAL MARSHALL said that though he had no reports from the theater commander on the matter, General Donovan had informed him of the excellent work accomplished by O.S.S. personnel in Sicily. He had felt that even better results could have been obtained if they had been allowed to land prior to the operation, or at least in the first wave. He (General Marshall) believed that since no immediate military operations were planned against Sardinia, it would be well worthwhile to allow O.S.S. and S.O.E. to operate freely in this island. They might succeed in enabling an unopposed landing to be achieved or to seize airfields or other strategic points and

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hold them as centers of resistance. He had not, of course, as yet discussed this matter with General Donovan.

GENERAL MARSHALL then presented a draft telegram to General Eisenhower suggesting that O.S.S. and S.O.E. should be given a free hand to operate in the island of Sardinia.

SIR ALAN BROOKE asked for time to consider this proposal.

THE COMBINED CHIEFS OF STAFF:-

Took note of a proposal submitted by the U.S. Chiefs of Staff that General Eisenhower be requested to comment on a suggestion to gain an unopposed occupation of Sardinia by fifth column activities.

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HABBAKUK BOARD

MEMBERSHIP OF COMMITTEES

PLANNING AND PROGRAM

Rear Adm. B. Moreell (CEC) USN — Chairman
Rear Adm. Dewitt C. Ramsey, USN
Vice Air Marshal G. V. Walsh, M.B.E., R.C.A.F.

DESIGN

Rear Adm. E. L. Cochrane, USN — Chairman
Rear Adm. B. Moreell (CEC) USN
Mr. J. W. Rivett

CONSTRUCTION

Construction Capt. A.N. Harrison, R.C.N. — Chairman
Rear Adm. E. L. Cochrane, USN
Mr. J. W. Rivett

TESTS

Cmdre. H.W.U. McCall, R.N. — Chairman
Vice Air Marshal G.V. Walsh, M.B.E., R.C.A.F.
Brig. Gen'l. C. C. Jamison, U.S.A.A.F.

PROGRESS CONTROL AND REPORTS

Rear Adm. B. Moreell (CEC) USN — Chairman
Rear Adm. E. L. Cochrane, USN
Const. Capt. A.N. Harrison, R.C.N.
Cmdre. H.W.U. McCall, R.N.

Membership of Committees

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HABBAKUK BOARD

S E C R E T C O P Y

BOARD MEMBER AND ALTERNATE	Address	Tel. No.
Rear Adm. Ben Moreell (CEC) USN Chair.	2022 Navy Bldg.	Navy 3281
Capt. W.H. Smith (CEC) USN Sec.	4421 Navy Bldg.	Navy 2932
Rear Adm. Dewitt C. Ramsey, USN	2087 Navy Bldg.	Navy 2560
Capt. Calvin M. Bolster, USN	1W66 Bldg. W	Navy 2692
Rear Adm. Edward L. Cochrane, USN	1804 T3	Navy 2056
Rear Adm. Charles L. Brand, USN	2034 T4	Navy 3585
Brig. Gen. Glen C. Jamison, USAAF	5A282 Pentagon	87 - 71127
Major W. N. Burgoyne, USAAF	3E123 Pentagon	War 87, Ext.71172
Comdre. H.W.U. McCall, R.N.	Rm 350, PHB	Exec. 1940, Ext. 50
Group Capt. J.W.F. Merer, RAF	Rm 328, PHB	Exec. 1940, Ext. 250
Mr. J. W. Rivett	11019 T4 P.O. Box 165 Benjamin Franklin Sta., Washington, D.C.	Exec. 0300, Ext. 239
Prof. J. D. Bernal	B.A.D. PHBldg.	
Vice Air Marshal G.V. Walsh, M.B.E. R.C.A.F.	2222 "S" St.,N.W.	Decatur 1011
Group Capt. A.L. James, R.C.A.F.		
Const. Capt. A.N. Harrison, R.C.N.	Ottawa (Canadian Joint Staff)	
Capt. V.S. Godfrey, R.C.N.	2222 "S" St., N.W.	Decatur 1011

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NAVY DEPARTMENT
BUREAU OF YARDS AND DOCKS
WASHINGTON, D. C.

YD Serial 01357

SECRET

OCT 14 1943

From: Chairman, Habbakuk Board.
To: Brig. Gen. Glen C. Jamison, USAAF,
Room 5A282, Pentagon Building

Subj: Habbakuk - Board Minutes and Data.

1. There are forwarded herewith Minutes of Meeting No. 1 of the Habbakuk Board held October 12, Report by the Joint Administrative Committee on this subject, technical documents submitted by British members of the Board and list of committee membership.

W. H. Smith
Secretary

Encls.
1. Minutes of Meeting No. 1, Oct. 12, 1943.
2. Report by the Joint Administrative Committee.
3. C.O.H. Document H/1685/A, Principles of Construction of Large Floating Air Bases.
4. Photostat, N.P.L. Document H/2509, Mechanical Properties of Pykrete.
5. British Document H/576, Visit to RRL 3/18/43.
6. British Document H/1045, Visit to RRL 5/6/43.
7. British Document H/1964, Formation of Low Consistency Pulp Slabs from groundwood pulp suspensions.
8. British Document H/5124, Pykrete micro-reinforcement.
9. British Document H/5127, Visit to B.P.I. Oct. 1-4, 1943.
10. British Document H/5128, Notes on outstanding problems in Research and Development.
11. British Document H/5129, Memo on Trial Section.
12. British Document H/5140, Naval Design Notes.
13. Notes on conference of 10/6/43.
14. List of committees and membership.

encls 3-14 in Plans file.

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HABBAKUK BOARD
MINUTES OF MEETING NO. 1
OCTOBER 12, 1943

The board convened at 1000 in Room 3601, Navy Bldg.
Present:

Rear Admiral Ben Moreell (CEC), USN	Chairman
Capt. William H. Smith (CEC), USN	Deputy and Secretary
Rear Admiral DeWitt C. Ramsey, USN	Member
Rear Admiral Edward L. Cochrane, USN	Member
Rear Admiral Charles L. Brand, USN	Deputy
Brigadier General Glen C. Jamison, USAAF	Member
Major W. M. Burgoyne, USAAF	Deputy
Commodore H.W.U. McCall, RN	Member
Group Captain J.W.F. Merer, RAF	Deputy
Mr. J. W. Rivett	Member
Vice Air Marshal G.V. Walsh, M.B.E., R.C.A.F.	Member
Group Captain A. L. James, RCAF	Deputy
Construction Captain A. R. Harrison, RCN	Member
Captain V. B. Godfrey, RCN	Deputy

The Chairman read the precept convening the Board.

Commodore McCall requested that Group Captain Merer, RAF, be designated as his deputy, vice Captain Tollemache.

The Chairman proposed the creation of five committees to handle the detail work of the Board, and outlined their respective functions. After discussion, it was moved by Rear Admiral Ramsey and seconded by Commodore McCall that the following committees be appointed, as proposed by the Chairman:

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(a) Planning and Program		
	Rear Adm. B. Moreell (CEC) USN	Chairman
	Rear Adm. DeWitt C. Ramsey, USN	
	Vice Air Marshal G.V. Walsh, M.B.E., RCAF	
(b) Design		
	Rear Adm. E. L. Cochrane, USN	Chairman
	Rear Adm. B. Moreell (CEC) USN	
	Mr. J. W. Rivett	
(c) Construction		
	Construction Capt. A.N. Harrison, RCN	Chairman
	Rear Adm. E. L. Cochrane, USN	
	Mr. J. W. Rivett	
(d) Tests		
	Cmdre. H.W.U. McCall, RN	Chairman
	Vice Air Marshal G.V. Walsh, M.B.E., RCAF	
	Brig. Gen'l. G. C. Jamison, USAAF	
(e) Progress Control and Reports		
	Rear Adm. B. Moreell (CEC) USN	Chairman
	Rear Adm. E. L. Cochrane, USN	
	Const. Capt. A.N. Harrison, RCN	
	Cmdre. H.W.U. McCall, RN	

Rear Admiral Cochrane asked whether arrangements had been made for financing the project. It was agreed that estimates of cost would be included in the Planning and Program Committee report and that financial arrangements would then be resolved.

Rear Admiral Cochrane inquired whether a time schedule had been set for the completion of the Board's work. Mr. Rivett stated that it had been planned initially that the preliminary work would be completed by midsummer of 1944 and that the full size Habbakuk II would be completed by midsummer of 1945. The Chairman stated that no specific directive

Minutes 12 Oct '43

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had been given the Board with respect to a time schedule and it was agreed that this directive would be requested.

It was agreed that meetings of the Board would be held monthly, during the last week of the month and on a specific day of the week to be designated later, and that the monthly report to the Combined Chiefs of Staff would be submitted as of the first day of the month.

Rear Admiral Cochrane requested that copies of all prior documents giving background information on the project be distributed to each member. The Secretary was directed to comply.

Captain Merer inquired whether the Board's functions were limited to Habbakuk II or whether the Board should also consider Habbakuks I and III and other alternatives. It was agreed that clarification of the directive in this respect would be requested.

Commodore McCall noted that several British experts were available and ready to proceed on the technical phases of the program. The secretary was directed to furnish the names, addresses and capacities of these experts to the committee chairmen.

Group Captain Merer inquired whether members and deputies not on committees would be in contact with the committees. The Chairman replied

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in the affirmative.

Rear Admiral Cochrane emphasized the need for a clear definition of the military objectives of Habbakuk II and of the operational characteristics to fulfill those objectives. Group Captain Merer stressed the desirability of utilizing Habbakuk II for bombers. It was agreed that a list of recommended characteristics would be submitted to the Combined Chiefs of Staff for approval, and Rear Admiral Cochrane was directed to prepare the list.

General Jamison asked whether it was possible to make Habbakuk II considerably longer than 2000 feet. This question was discussed from the design and construction standpoints. It was agreed that the chairman of the Design Committee would consult with the other members of the Board to determine the basic characteristics, and that a tentative specification for the military characteristics would be referred to the convening authority for approval.

The meeting was adjourned at 1130 to await further call from the Chairman.

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ENCLOSURE

HABBAKUKS

References: a. C.C.S. 315/1, C.C.S. 315/2.
b. C.C.S. 112th Meeting, Item 3.
c. J.C.S. memo. directive,
21 August 1943.

Report by the Joint Administrative Committee

THE PROBLEM

1. To submit recommendations to the Joint Chiefs of Staff on the method of implementing paragraph c of the decisions made by the Combined Chiefs of Staff in reference b above.

FACTS BEARING ON THE PROBLEM

2. The Combined Chiefs of Staff, at their 112th Meeting (Item 3), agreed that a combined United States, British and Canadian board should

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be constituted to construct a section of HABBAKUK II, to continue design, to study the construction and facilities necessary for a full size ship, and to make a monthly progress report to the Combined Chiefs of Staff.

3. The report on HABBAKUKS, prepared by the Chief of Combined Operations and circulated as C.C.S. 315, states that construction cannot be undertaken in the United Kingdom because of unavailability of both labor and material.

CONCLUSIONS

4. The nature of the undertaking, and the unavailability of British resources therefor, indicate that the U.S. Navy is the logical instrumentality for assuming the initiative in implementing the decision of the Combined Chiefs of Staff above referred to.

Duplicate for Board

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RECOMMENDATIONS

5. It is recommended that:

a. The Commander in Chief, U.S. Fleet, and Chief of Naval Operations be directed to establish a Board from amongst the appropriate agencies of the Navy Department, and that invitation to membership thereon be extended to the U.S. Army Air Forces, and to the appropriate British and Canadian authorities.

b. This Board be charged with the responsibility for:

(1) Construction of a section of HABBAKUK II;

(2) Continuing the design of a full size HABBAKUK II;

(3) The study of the construction and facilities necessary for a full size HABBAKUK II;

(4) Submitting to the Combined Chiefs of Staff a monthly report on its progress.

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(SC) N15-5/A1-1
D-1

YD Serial 01345

NAVY DEPARTMENT
BUREAU OF YARDS AND DOCKS
WASHINGTON, D. C.

SECRET

From: Chairman, Habbakuk Board.
To: Brigadier General Glen C. Jamison, U.S.A.A.F.
Room 5A282, Pentagon Building.

Subj: Habbakuks - Board to Construct Section, Continue Design and Study Construction and Facilities for.

Ref: (a) Ltr. from VCNO to Rear Admiral Ben Moreell Op-12A/fhg (SC) LC/N10-1 Serial 0156212 of 8 October.

1. The Board ordered by reference (a), will meet at 1000 on Tuesday, 12 October 1943 in Room 3601, Navy Building.

W. H. Smith
Secretary

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Op-12A/fhg
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Serial 0156212

8 October 1943

S E C R E T

SECRET

From: The Vice Chief of Naval Operations.
To : Rear Admiral Ben Moreell, (CEC), U.S. Navy.

Subject: HABBAKUKS, -- Board to Construct Section, Continue Design, and Study Construction and Facilities for.

References:
(a) C.C.S. 315/5.
(b) CominCh Sec.Security ltr. Serial 002002 of 20 Sept. 1943 to VCNO.
(c) VCNO Sec.Serial 0143012 of 22 Sept. 1943 to General Arnold.
(d) Ltr. to Adm. Horne from Maj. Gen. Barney M. Giles, dated 4 Oct. 1943. (Doc. 95767).
(e) VCNO Sec. Serial 0142912 to Field Marshall Sir John Dill, dated 22 Sept. 1943.
(f) B.A.D. Most Secret ltr. PW 134, dated 24 Sept. 1943 to VCNO.
(g) VCNO Sec. Serial 0143112 dated 22 Sept. 1943, to Maj. Gen. Pope.
(h) Secret ltr. from Maj.Gen. Pope, Canadian Joint Staff, to Admiral Horne, dated 5 October 1943, (Doc. 95942).

1. In accordance with the authority contained in references (a) and (b), a Board is hereby ordered to meet at the Navy Department at 10:00 A.M. on Saturday, 9 October 1943, or as soon thereafter as may be practicable, for the purposes indicated below.

2. The Board will be constituted as follows:

Rear Admiral Ben Moreell, (CEC), U.S. Navy, Chairman, with Captain William H. Smith, (CEC), U.S. Navy, as deputy.

Rear Admiral DeWitt C. Ramsey, U.S. Navy, member, with Captain Calvin M. Bolster, U.S. Navy, as deputy.

Rear Admiral Edward L. Cochrane, U.S. Navy, member, with Rear Admiral Charles L. Brand, U.S. Navy, as deputy.

Brigadier General Glen C. Jamison, U.S.A.A.F., member, with Major W. M. Burgoyne, U.S.A.A.F., as deputy.

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Commodore H.W.U. McCall, R.N., member with
Captain H. D. Tollemache, R.N., as deputy.

Mr. J. W. Rivett, member, with Professor J. D. Bernal
as deputy.

Vice Air Marshal G.V. Walsh, M.B.E., R.C.A.F., member, with
Group Captain A. L. James, R.C.A.F., as deputy.

Construction Captain A.W. Harrison, R.C.N., member, with
Captain W.S. Godfrey, A.C.N., as deputy.

Whenever a member is unable to attend a meeting he will be represented by his deputy, who shall have full plenary powers.

3. The authority for the membership of the United States Army Air Force member, the British members, and the Canadian members, and their deputies, is contained in references (c) to (h).

4. The Board, as established above, is charged with determining, and assigning among appropriate United States, British, and Canadian agencies, the work required to be accomplished in:

(a) The construction of a full size section of HABBAKUK II;

(b) Continuing the design of a full size HABBAKUK II;

(c) The study of the construction and facilities necessary for a full size HABBAKUK II.

5. The Board will exercise general supervision over the execution of the work listed above, and submit to the Combined Chiefs of Staff a monthly report of its progress.

6. The Board will establish its own procedure; form sub-committees, in its discretion, to assist it in the performance of its duties; and is authorized to request such assistance as may be required from appropriate authorities.

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7. Captain William N. Smith, (CEC), U.S. Navy, the deputy for Rear Admiral Morsell, will act as Secretary of the Board.

8. An assistant to the Secretary and the necessary clerical assistance will be provided on application to the Vice Chief of Naval Operations.

F. J. HORNE

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Wtn 10/2/43

Rear Admiral F. J. Horne,
Navy Department,
Office of the Chief of Naval Operations,
Washington, D. C.

My dear Admiral:

Acknowledgement is hereby made of your letter to General Arnold dated September 22nd, asking that two representatives of the Army Air Forces be designated to sit on a board approved by the Combined Chiefs of Staff to supervise the work incident to HABBAKUK II.

It is my pleasure on behalf of General Arnold to advise you that Brigadier General Glen C. Jamison is named to represent the U.S. Army Air Forces on the board. Major W. M. Burgoyne will act as his alternate or deputy.

Sincerely yours,

BARNEY M. GILES,
Major General, U.S.A.,
Chief of the Air Staff.

Copy for General Jamison

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HHA ltr to Adm H GCI 46 AAF rep

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NAVY DEPARTMENT
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
WASHINGTON

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22 Sept 1943

My dear General:

The Combined Chiefs of Staff, in their 119th Meeting, approved the recommendation contained in paragraph 2 of C.C.S. 315/5, as amended. Paragraph 2 of C.C.S. 315/5, as amended, reads as follows:

"2. The Combined Administrative Committee recommends that:

a. The Commander in Chief, U.S. Fleet, and Chief of Naval Operations be directed to establish a Board from amongst the appropriate agencies of the Navy Department and to fix its membership, and that invitation to membership thereon be extended to the U.S. Army Air Forces and to the appropriate British and Canadian authorities.

b. The Board, as established under a above, be charged with determining, and assigning among appropriate U.S., British, and Canadian agencies, the work required to be accomplished in:

(1) The construction of a full-size section of HABBAKUK II;
(2) Continuing the design of a full-size HABBAKUK II;
(3) The study of the construction and facilities necessary for a full size HABBAKUK II.

c. The Board exercise general supervision over the execution of the work listed in b above and submit to the Combined Chiefs of Staff a monthly report on its progress."

On 20 September 1943 the Commander in Chief, U.S. Fleet and Chief of Naval Operations directed me to take the necessary action to implement the decision of the Combined Chiefs of Staff regarding the establishment of the Board, invitations to membership thereon, and issuance of appropriate instructions to the Board.

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It has been tentatively decided to limit the U.S. membership to four officers, each to have an alternate or deputy. The U.S. Navy members will be the Chief of the Bureau of Ships, the Chief of the Bureau of yards and Docks, and the Chief of the Bureau of Aeronautics. Each of these officers will have an alternate or deputy to act for him in his absence.

On behalf of the Commander in Chief, U.S. Fleet and Chief of Naval Operations I wish to extend to you an invitation to nominate one officer from the U.S. Army Air Forces, with an alternate or deputy to act in his absence, to be a member of this Board.

For your information I am extending an invitation to the British to nominate two officers with alternates or deputies, and I am extending a similar invitation to the Canadians.

Very sincerely yours,

/s/ F J Horne

F. J. Horne

General H. H. Arnold, U.S.Army,
Commanding General, U.S. Army Air Forces,
Room 3E1012, Pentagon Building,
Arlington, Virginia.

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C.C.S. 315/1

19 August 1943

COMBINED CHIEFS OF STAFF

"HABBAKUKS"

Memorandum from the United States Chiefs of Staff

The U. S. Chiefs of Staff have given careful consideration to the proposals submitted by the British Chiefs of Staff in C.C.S. 315 and have reached the following conclusions:

a. By the expenditure of extraordinary effort and consequent stoppage of other essential war projects, the construction of HABBAKUK II and an erecting plant therefor is feasible and might be completed as early as the end of 1945.

b. Construction of HABBAKUK III could possibly be accom-

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plished by the end of 1945. Claims for invulnerability of HABBAKUK III to hull damage may be somewhat justified, but they are outweighed by the operating advantages inherent in conventional carrier types by virtue of speed, maneuverability, and operating refinements.

c. Due to the relatively small value of the HABBAKUKS in increasing the effectiveness of aircraft operation, and in view of the existing aircraft carrier program, the diversion of manpower and critical materials involved in their construction is not warranted.

CCS 315/1

See para. 3, pg. 1 and 2

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C.C.S. 112th Meeting

19 August 1943

COMBINED CHIEFS OF STAFF

QUADRANT CONFERENCE

Minutes of Meeting held in Room 2208,
Chateau Frontenac Hotel, on Thursday,
19 August 1943, at 1430.

PRESENT

General G. C. Marshall, USA
Admiral E. J. King, USN
General H. H. Arnold, USA
General Sir Alan Brooke
Admiral of the Fleet
Sir Dudley Pound
Air Chief Marshal
Sir Charles Portal

ALSO PRESENT

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Rear Adm. C. M. Cooke, Jr., USN
Rear Adm. O. C. Badger, USN
Brig. Gen. L. S. Kuter, USA
Brig. Gen. A. C. Wedemeyer, USA
Commander V. D. Long, USN

Vice Admiral
Lord Louis Mountbatten
Lt. Gen. Sir Hastings L. Ismay
Brigadier W. Porter
Brigadier M. W. M. Macleod
Captain L. E. Porter, R.N.
Air Commodore B. Warburton
Professor Bernal
(For part of Item 5)

PRESENT FOR ITEMS 5, 6 AND 7

Lt. Gen. B. B. Somervell, USA
Vice Adm. R. Willson, USN
Maj. Gen. T. T. Handy, USA
Maj. Gen. M. S. Fairchild, USA

Field Marshal Sir John Dill
Gen. Sir Thomas Riddell-Webster
Admiral Sir Percy Noble
Lt. Gen. G. N. Macready
Air Marshal Sir R. Welsh

SECRETARIAT

Brigadier H. Redman
Brig. Gen. J. R. Deane, USA
Capt. F. B. Royal, USN
Comdr. R. D. Coleridge

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1. CONCLUSION OF THE PREVIOUS MEETING

THE COMBINED CHIEFS OF STAFF:-

Accepted the conclusions of the 111th Meeting. The detailed record of the meeting was also accepted, subject to minor amendments.

2. PROGRESS REPORT TO THE PRESIDENT AND PRIME MINISTER

THE COMBINED CHIEFS OF STAFF had before them a draft progress report to the President and Prime Minister.

THE COMBINED CHIEFS OF STAFF:-

Approved the Progress Report to the President and Prime Minister.

3. HABBAKUKS
(C.C.S. 315 - 315/1)

LORD LOUIS MOUNTBATTEN said that HABBAKUKS might be regarded as floating seadromes or giant aircraft carriers. They could be used as floating advance landing grounds and could form a staging base for air attacks. They might ultimately be used for four-engined heavy bombers. He outlined the principal characteristics of the three types. He then referred to pykrete, the material from which it was proposed to construct HABBAKUK [illegible] material of which there was an

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11. This might prove a strategic material of which there was an abundant supply. It was formed of a frozen mixture of diluted pulp and water, the latest type of which contained 94 per cent water. He gave details of the characteristics and strength of this material. A thousand ton model had been built and had spent the summer in Lake Jasper, refrigeration being maintained by means of an engine of only 15 horsepower. He wished to emphasize that a HABBAKUK II, constructed of pykrete, had no limit to its size. Four-engined bombers could use them if they were built of sufficient dimensions or if adequate arrester gear and assisted take-off could be arranged.

SIR CHARLES PORTAL said that the British Chiefs of Staff regarded HABBAKUK II as essentially a Pacific project. General Arnold had mentioned the difficulty of providing adequate bases in the Islands for the deployment of air forces for the bombardment of Japan. It would be a long time before the supply route to China allowed the maintenance of large air forces in that country and therefore the HABBAKUKS might be regarded as strategic bases or staging points for air attacks against Japan and would thus fill a gap in our facilities. They could be provided without impinging on other programs.

ADMIRAL KING said that he would agree to accept the recommendations contained in paragraph 8 b of C.C.S. 315.

In reply to a question by General Arnold, LORD LOUIS MOUNTBATTEN said that it was proposed that experiments and construction of pykrete sections for HABBAKUK II should proceed during the coming winter. If these experiments proved successful, construction could start in the Spring of 1944 and the completed HABBAKUK be ready by the Spring of 1945. In the meanwhile no delay must occur in the preparation of plans and construction of sites for the building of the HABBAKUKS.

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He asked that the Combined Chiefs of Staff should also approve the setting up of a U.S.-British-Canadian Board to press on with the whole matter, not only with regard to the winter experiments and the preparation of sites, but also with the preparation of drawings for the completed HABBAKUK. This Board should, in order to insure results, be asked to report monthly to the Combined Chiefs of Staff.

PROFESSOR BERNAL demonstrated with the aid of samples of pykrete the various qualities of this material.

THE COMBINED CHIEFS OF STAFF:-

a. Took note of paragraphs a, b, and c of C.C.S. 315/1.

b. Agreed to the construction of a section of HABBAKUK II, the continuation of design, and the study of the construction and of the facilities necessary for a full-size ship. This agreement to be incorporated as paragraph d in C.C.S. 315/1.

c. Agreed that the appropriate United States, British and Canadian authorities should be invited to set up a Board forthwith to press on with the action agreed in b above, and to report progress monthly to the Combined Chiefs of Staff.

4. LANDING CRAFT

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a. Manning of Landing Craft
(C.C.S. 286/3)

THE COMBINED CHIEFS OF STAFF:-

Agreed to the modified proposal put forward by the British Chiefs of Staff in paragraph 2 of C.C.S. 286/3.

b. Allocation of Landing Craft - Operation OVERLORD - Vehicle Lift
(C.C.S. 314)

THE COMBINED CHIEFS OF STAFF:-

Agreed with the proposal of the British Chiefs of Staff in paragraph 4 of C.C.S. 314 that the possibility of arranging an increase in the number of LCT(6) available for OVERLORD from American sources should be explored.

c. Allocation of Landing Ships and Craft - American Production
(C.C.S. 314/1 - 314/2)

LORD LOUIS MOUNTBATTEN explained that under the present ruling the Combined Munitions Assignments Board would feel themselves bound to allocate landing craft only to specifically projected operations. In order that the British should be able to play their part in operations in the Pacific, it was necessary for them to enter and train adequate personnel to man landing craft. If the present ruling were followed landing craft could be only allocated for specifically agreed operations which at present did not exist in the Pacific

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Theater. The British assault force which was in fact available and used for Operations TORCH and HUSKY had of necessity been built up before these actual operations were decided on. He felt that the allocation of landing craft should be based on agreed strategy rather than on agreed operations.

GENERAL MARSHALL said that the present position was such that there was everywhere a deficit of landing craft. Our operations were limited in many cases solely by the lack of these vessels. In view of this over-all deficiency, he felt it essential to retain the ruling that landing craft should be allocated only to specifically agreed operations.

ADMIRAL KING said he would like to know the future construction program for landing craft in the United Kingdom. He appreciated the necessity for the provision of landing craft for training purposes.

ADMIRAL KING then suggested a modification to proposal 3 b, in C.C.S. 314/1, designed to meet Lord Louis Mountbatten's point.

THE COMBINED CHIEFS OF STAFF:-

Approved paragraph 3 b of the enclosure to C.C.S. 314/1 modified to read as follows:

"That the British should now work out their training requirements and submit requests for a corresponding share of U.S. production in 1944-45."

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5. USE OF "PLOUGH" FORCE
(C.C.S. 316)

GENERAL MARSHALL said that the U.S. Chiefs of Staff agreed with the proposal that the capabilities of the PLOUGH force should be communicated to General Eisenhower and General Morgan who should be asked to report to the Combined Chiefs of Staff whether these forces could be usefully employed in their theaters. This force had already been ordered to withdraw from Kiska.

LORD LOUIS MOUNTBATTEN suggested that it would assist the two commanders if a United States officer from PLOUGH force could proceed to the two theaters to give details of the capabilities of the force. He himself could also send an officer.

THE COMBINED CHIEFS OF STAFF:-

a. Took note that Admiral Nimitz and General DeWitt had been directed to return the PLOUGH force to the United States on the first available transportation.

b. Concurred in the proposal presented in paragraph 4 of the enclosure to C.C.S. 316.

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6. EQUIPPING ALLIES, LIBERATED FORCES AND FRIENDLY NEUTRALS (C.C.S. 317)

SIR ALAN BROOKE said that the British Chiefs of Staff had not yet had time to consider this paper.

GENERAL MARSHALL put forward certain amendments to the paper, which were suggested by the U.S. Chiefs of Staff.

THE COMBINED CHIEFS OF STAFF:-

a. Took note of certain amendments presented by the U.S. Chiefs of Staff.

b. Agreed to defer action on the paper until the next meeting.

7. SPECIAL OPERATIONS IN SARDINIA

GENERAL MARSHALL said that though he had no reports from the theater commander on the matter, General Donovan had informed him of the excellent work accomplished by O.S.S. personnel in Sicily. He had felt that even better results could have been obtained if they had been allowed to land prior to the operation, or at least in the first wave. He (General Marshall) believed that since no immediate military operations were planned against Sardinia, it would be well worthwhile to allow O.S.S. and S.O.E. to operate freely in this island. They might succeed in en-

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abling an unopposed landing to be achieved or to seize airfields or other strategic points and hold them as centers of resistance. He had not, of course, as yet discussed this matter with General Donovan.

GENERAL MARSHALL then presented a draft telegram to General Eisenhower suggesting that O.S.S. and S.O.E. should be given a free hand to operate in the island of Sardinia.

SIR ALAN BROOKE asked for time to consider this proposal.

THE COMBINED CHIEFS OF STAFF:-

Took note of a proposal submitted by the U.S. Chiefs of Staff that General Eisenhower be requested to comment on a suggestion to gain an unopposed occupation of Sardinia by fifth column activities.

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(SC)N16-6/A1-1
YD Serial 01788
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NAVY DEPARTMENT
BUREAU OF YARDS AND DOCKS
WASHINGTON, D.C.

SECRET

4 March 1944.

From: Chairman, Habbakuk Board.
To: Brigadier General Glen C. Jamison, USAAF.

Subject: Habbakuks - Board to Construct Section, Continue Design and Study Construction and Facilities for.

Reference: (a) CNO Serial Secret 077912 ltr. of 1 March 1944 to Rear Admiral Ben Moreell (CEC) USN.

1. Copy of reference (a) is forwarded herewith for your information.

Secretary

Encl: 1: Copy of reference (a).

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Re BAHRAIN

FILE NO.
145.81-158
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AC/AS, PLANS

Date 2/21/44

SUBJECT: Habbakuks and Tentacles. D/F fr CPD (OPD 600.12 Sec 2/18/44) to CG, AAF dtd 2/21/44 (in dup.) no incls

The above described SECRET - SECURITY papers have been received this date in this office. Circulation of these papers will be strictly limited to those whose work is involved, and the name of each person who handles or has knowledge of their contents will be entered below as indicated.

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NAME	DATE	TIME	PURPOSE	ALL PAPERS ATTACHED:
M Rockaway	2-22-44	8.30	Recd	yes
Wm Sandefur	2-22-44	9.15	Info.	yes
M. Carlon	2-22-44	9.20	Recd	yes
[illegible]	2/22/44	17.40	Info	yes

MEMORANDUM FOR THE RECORD:

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MEMORANDUM ON THE TRIAL SECTION OF HABBAKUK
TO BE BUILT IN THE WINTER 1943/44

H/5129

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1. Purpose

The purpose of the trial section and the general scope of research and development work which needs to be carried out this winter are set out in Professor Bernal's memorandum which is attached to this note.

2. Dimensions of section

For a variety of reasons set out in Prof. Bernal's report, it is considered essential that all dimensions should be approximately of the order envisaged for the prototype, i.e., width 154 ft., height 125 ft. (prototype 300 ft x 200 ft) thickness of wall, bottom and depth 40 ft., (prototype 40 ft.) bulkheads (forming the ends of the section 20 ft., length 200 ft., total displacement 91,000 tons. All detailed designs have yet to be prepared. If it is intended to complete the section by the end of April preparatory work would have to be done now with all possible speed.

3. Site for building section

This should be the same as the site chosen for the construction of prototype, in order to avoid wasting time in dismantling, transporting and re-erecting production plant and losing the technique acquired by the operators and constructors.

4. Production of Pykrete

(a) Pykrete has so far only been made on a semi-laboratory scale. Methods for large scale production have been considered but not actually tried. It is suggested that a pilot plant with a production capacity of the order of a few tons per day be put in hand at the earliest possible moment. Detailed proposals for this plant can be submitted by us after we shall have had an opportunity of discussing the results of research done in Canada.

(b) If a model section of about 91,000 tons is to be built this winter, it may be assumed that it would have to be completed by the end of April. This would be done if a Pykrete plant of a production capacity of 1000 tons a day could start operating by February 1st. Plans and design for this plant would therefore have to be put in hand straightway and orders placed for the necessary refrigeration plant and other equipment. The plans could then be altered in points of detail from the experience gained on the small pilot plant. It has been found that natural freezing is impractical in view of the inaccessible nature of all possible sites in sufficiently cold climates. Artificial freezing will have to be used therefore.

(c) Pykrete could be made in blocks weighing several tons. These blocks will have to be machined to even dimensions. The section would have to be built from such blocks joined together with Pykrete mortar. The optimal size of blocks has yet to be determined.

5. Insulating material

Several insulating materials have been proposed. The most promising material is a saw dust resin compound; it has to be ascertained whether sufficient quantities of saw dust and resin would be available. If not, another material would have to be tried.

6. Filler

It is desirable that the void of the ship should be filled with a light material and not left empty. The filler should act as a strut between the bottom and deck and provide an additional safeguard against

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flooding. Sawdust resin compound or a frozen resin sponge partially soaked with water or a frozen mixture of snow and wood-flour have been proposed. The first two would be satisfactory but present difficulties of supply, while the latter needs developing.

7. Refrigerating plants

(a) Pykrete production. A pykrete plant capable of producing 1000 tons of the material per day would require refrigeration plant totalling 3750 B.H.P.

(b) Maintenance of trial section. To maintain the section throughout the summer in a temperate climate a plant with an output of 800,000 B.T.U.'s per hour is required which corresponds to a driving power of 300 B.H.P.

(c) Development and testing. It is envissged that the refrigerating ducts should be made of water-proof cardboard sealed to the bulk with pykrete mortar. This needs trial and development. A method of construction of sections of the duct system has to be developed, particularly with a view to cooling the bottom of the section while the rest is being constructed. Evaporation of ice from the pykrete may, nevertheless, become a problem and cause frosting of the air cooler. Efficient defrosting of the air cooler has to be insured. Evenness of air flow also will have to be checked within the cooling system.

8. Other Construction problems of which there are many but four deserve particular mention.

(a) Method of construction on scows
(b) Block construction using pykrete as mortar
(c) Attachment of insulation
(d) Attachment of engine nacelles

9. Tests on completed model section

(a) Effect of torpedo damage both immediate and subsequent erosion by waves.

(b) Effect of bombs.

(c) Development of repair system for underwater damage.

10. Other tests on pykrete

An account of these is given in Professor Bernal's report under 5128/M

(M.F. Perutz)

Washington, D.C.
October 8th, 1943

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H A B B A K U K II

NAVAL DESIGN NOTES

For technical description of structure and methods of construction see "Review of Habbakuk II" Section IV, Ref; H/1477 dated 8th July 1943 and issued from Combined Operations Headquarters, London.

Principal Dimensions

Length O.A.	2000'0"
Breadth. Ex.	300'0"
Depth	200'0"
Draft	150'0"
Freeboard	50'0"

Form

The form of the vessel as shown on the Lines Drawing was deduced from experiments carried out at the Froude National Experimental Tank and it was the considered opinion of the superintendent that any further fining would reduce the resistance but slightly bearing in mind that simplicity of form of hull was essential.

Displacement at 150 ft. draft = 2,002,930 English tons

Speed Power

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It was agreed that in order to give some directional stability the minimum speed should be 7 knots. The effective horse power calculated from the model experiments and based on Froude's skin friction constants was 14,450 for the above speed. No allowances were made for appendages. The total horse power required at the shafts was 32,500 with a propulsive coefficient of 0.44. To absorb this power at a speed of 7 knots, 26 propellors 14 feet in diameter running at 110 revolutions per minute would be required. The type of propulsion machinery proposed was Diesel Electric but it was also suggested that Turbo Electric Machinery might be more readily procurable and would take up much less space. It was estimated that 14 sets of Main Diesel Engines each 3,500 B.H.P. directly coupled to electric generators each with an output of 2,450 kilowatts would be necessary to give the required H.P. at the propellors: These latter to be driven by electric motors each 1,250 H.P. enclosed in welded steel nacelles arranged to the best advantage along the sides of the vessel.The thrust at each propellor amounts to 11.5 tons.

Model trials were also carried out for a displacement of 1,865,350 tons at a lighter draft. The effective horse power required for a speed of 7 knots was 13,285 as compared with 14,450 for the higher displacement. Therefore a speed slightly in excess of 7 knots would be obtained at a reduced draft for the same power.

Longitudinal Strength

This was estimated on the assumption that the worst waves likely to be met with would not exceed 1,000 ft. in length with an amplitude of 45 feet. By the usual ship methods of calculation a maximum Bending Moment of 9,450,000 foot tons was obtained. Throughout the calculations the thickness of the

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sides, top and bottom has been fixed at 40 feet. Steel reinforcement is impracticable due partly to creep and also that an extremely large amount would be required to be effective. A certain amount of wood reinforcement might be used but it would hardly be worth while since the modular ratio of wood to Pykrete is only 2 to 1. It was, therefore, considered that the Pykrete would have to take all the tensile and compression stresses. On this basis a maximum fibre stress of 87 lbs. per square inch was obtained without any reduction of area of section due to, refrigeration ducts, ventilation and access trunks, water circulating inlets and outlets and exhaust trunks from main engines. It has, therefore, been estimated that with reasonable deductions for these, the stress would be approximately 100 lbs. per square inch.

Ultimate Tensile Strength of Pykrete = 700 lbs/sq.in.
" Compressive " " = 1100 lbs/sq.in.

This then gives a factor of safety of 7.

The tensile strength of Pykrete as given above was obtained from a solid block of the material but if block construction of the vessel is to be considered, owing to the much lower modulus of rupture obtained from an experimental brick beam, means will have to be found to restore the strength to as near 700 lbs. per sq. in. as possible, by the use of a suitable mortar or some efficient means of interlocking. Although with very large steel ships the factor of safety may be as low as 4 or 5 it might be considered unsafe in a vessel such as is proposed.

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Approximate Preliminary Estimate of Weights

ITEM	Wt. in tons
Hull of Pykrete at .988 Sp. G.	1,670,000
Timber approx. (insulation decks etc.)	35,000
Cellular Construction (Sawdust resin)	275,000
Steel	5,000
Main Diesel Engines Generators and Auxiliaries in Engine Rooms	3,500
Propelling units complete with Housing) (26 in numbers)	1,200
Oil Fuel & Lubricating oil for 3,500 miles	2,500
Cooling machinery Refrigeration and Ventilation	4,450
Outfits and Fittings	500
Crew and effects (say 1500)	250
Stores (say)	600
Fresh water, allow	2,500
Margin	5,000
TOTAL	2,005,500

Notes Thickness of Pykrete Hull has been taken as 40 ft. and the Pykrete consists of 14% wood pump and 86% ice

Displacement calculated from Lines Drawing
= 2,112,930 tons at 150 ft. draft.
Tons per inch immersion = 1,245 tons.

Total volume of Pykrete = 60,621,480 ft.^{3}
Weight of Wood Pulp required = 233,800 tons.

Hydrostatic Pressure on Bottom

Pressure on bottom due to 150 ft. head of sea water = 66.5 lbs/sq.in.

Total upward pressure uniformly distributed over an area 220 ft. (neglecting 40 ft. walls) by 1 foot in width = 940 tons.

Weight of Bottom acting downwards = 240 tons

Net load on strip of Bottom 1 foot in width uniformly distributed = 700 tons.

Assuming a uniformly loaded beam with 100% end restraint

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From Deflection = $\frac{W L^3}{384 EI}$ $I = 480^3$ Ins.^{4}

$E = 750{,}000$ lbs/sq.in.

We get 0.905 ins. Deflection

Reaction at ends = $\frac{W}{2}$ = 350 tons

Area of Section = 5,760 sq.ins.

Shear Stress = 138 lbs/sq.in.

Bending Moment = $\frac{W L}{24}$ = 77,040 In.Tons.

Stress = $\frac{My}{I}$ = .167 tons = 376 lbs/sq.in.

Transverse Strength of Deck

Assume strip of deck 220 ft. x 1 foot in width x 30 ft. in depth

Uniformly distributed weight due to its own weight = 240 tons.

Taking 100% end restraint and

$E = 750{,}000$ lbs/sq.in.
$I = 480^3$ Ins.^{4}

Deflection = $\frac{W L^3}{384 E I}$ = 0.31 Ins.

Shear Stress and stress due to Bending would be only 1/3 those at the Bottom.

/s/ H. W. WRIGHT.

Washington, D.C.
October 11, 1943.

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8 October 1943.

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MEMORANDUM FOR FILES:

Subj: Habbakuk II, Notes of Conference of October 6th.

Present: Capt. W. H. Smith
Mr. J. W. Rivett, British Admiralty Delegation
Dr. Perutz, British Admiralty Delegation
Mr. Green, British Admiralty Delegation.

1. At this conference the technical and physical characteristics of pycrete, resin block and insulation for Habbakuk II were discussed and the following data obtained supplementing that previously available.

2. Pycrete is a mixture of about 14% ground wood pulp and 85% water weighing approximately 60# per cubic foot. It has a low coefficient of heat transmission and if the pulp can be retained by wire mesh or equivalent means against the damaged section which is no longer refrigerated, the wet pulp serves as an insulation to retard further melting.

3. Ground pulp was tested by Professor Mark of the Brooklyn Polytechnic Institute and Professor Howenstein under private arrangements for COHQ, London. Dr. Howenstein was not informed of the purpose of the test and his report is therefore misleading in certain respects. It was found that fibrous materials are the best suited for mixture with water to form a frozen structural material, the efficiency depends largely on the wetability of the material and that ground pulp is more effective despite its relative lack of fiber because it prevents cracks, decreases the crystal size of the ice and forms a relatively fine grained ice structure. It has the further advantage that it is produced by the standard method for producing wood pulp for paper manufacture. In the event that the trial section or the prototype of the Habbakuk II must be built on the West Coast, it will be necessary either to ship the pulp from the East Coast or to ship the pulp grinding machinery to the West Coast. The latter course is more economical.

4. The contemplated process of manufacture is as follows. The wood pulp would be ground in a standard 50 ton per day pulp machine which exudes a thin layer of pulp onto a discharge belt. The pulp content can be varied from 5 to 20%. The lower concentrations are unsatisfactory because water is expelled during the freezing process causing segregation of pulp and water. The higher concentrations are unsatisfactory because the material becomes so stiff and crumbly that it is unmanageable. Parallel tests have been conducted in Canada using spruce pulp wood which reported best results with 6 to 8% pulp content. Dr. Perutz has not seen the Canadian material and is unable to confirm their conclusions. These tests were conducted by Dr. Cook of the Biological Research Laboratory of Montreal and Professor Williams of Ottawa. The British tests were conducted with Bowater and Lloyd, English paper manufacturers. The layers of pulp from

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the pulp machine are approximately 3/8" thick. It is contemplated that these layers will be fed continuously from the machine by a belt onto a specially designed freezing truck and that these trucks will pass through wind tunnels in which air at -15° centigrade is blown at 17.5 miles per hour. Under these conditions the layer is frozen in 20 minutes. At -5° centigrade it takes 90 minutes to freeze one layer while at -25° centigrade the time is shortened only to 15 minutes.

5. Tests have also been made of varying the wind speed. Freezing takes place in 42 minutes at 3 miles per hour, in 31 minutes at 8 miles per hour, in 21 minutes at 14 miles per hour and in 20 minutes at 17.5 miles per hour. Higher velocities do not materially increase the speed of freezing. No experiments have been made using direct radiation from freezing coils lowered close to the layer being frozen.

6. No definite size of ice block has been decided upon. The general conclusion is that the block should be the largest size compatible with available weight handling equipment, possibly about 10 tons. A 12'x6'x3' block weighing about 65 tons seems to be indicated. This would require approximately 96 layers requiring about 32 hours continuous operation for the manufacture of one block. It will be necessary to plane all faces of the block to secure uniform size for effective placing and jointing in the structure. The larger the block the less the waste from this operation.

7. It was agreed that if the Habbakuk was to be used in the Pacific, it would be necessary to construct it on the West Coast where no sites are available at which natural freezing can be obtained and that therefore the manufacture must be based upon mechanical refrigeration requiring an installation in the neighborhood of 35,000 horsepower. No survey has been made to determine whether such equipment is available. No details have been studied for the arrangement and equipment of the block manufacturing plant.

8. Pycrete has a relatively high degree of creep under stress. It was agreed that this characteristic would necessitate careful study of the structural arrangement particularly with respect to the support of the top deck over the central void and resin blocks. No structural solution has been worked out in detail. Some consideration has been given to the question of fatigue of pycrete under repeated stress. The conclusion has been reached that no trouble will be encountered from this source since the pycrete is considered as self-annealing. No consideration has been given to the amount of heat rise due to the internal work performed in resisting stress. Comdr. Westergaard was consulted on this and the conclusion was reached that the additional refrigeration required to overcome the heat due to internal work would be negligible.

9. The British representatives explained the various types of insulating skin contemplated for Habbakuk II. The contemplated arrangement consisted of two layers of 2" timbers laid in pitch supported on framing of 2x8 joists with the spaces filled with glass wool in watertight envelopes or with sawdust resin blocks dipped in paraffin wax and sheathed internally with a third layer of 2" timber sealed with pitch. The glass wool block

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has been discarded in favor of the resin blocks. Schemes have also been evolved for making up panels of this construction and securing them to backing timbers so that they can be readily removed and replaced if damaged.

10. The resin blocks are similar in form to the resin sawdust boards which are now being produced by the Minister of Supply in England. They consist of 50% sawdust and 50% urea formaldehyde resin by weight or 8 parts of sawdust to 1 part of resin by volme. They weigh approximately 55# per cubic foot and would be made 4'-6" square by 6" thick. It is reported that tests on these blocks show no deterioration after five months exposure. Approximately 1,000,000 cubic feet would be required of such blocks for Habbakuk II as contemplated by the British. This would require over 12,000 tons of resin which is already in short supply. The resin block yields more than pycrete under stress. This characteristic would have to be taken into account in the design of the structure. Other types of insulation have been discarded because of their lack of strength to resist hydrostatic pressure or their lack of insulating value when wet. In the discussion it was agreed that pitch alone could not be relied upon to insure effective waterproofing and that an internal membrane waterproofing would probably be necessary. Alternatives to the resin block which have been considered include porous ice, having a specific gravity of 0.5, designated as picolite; a viscous sponge partially saturated with water and frozen, designated as acropic; and a mixture of wood flour and snow designated as pulvopic. Pulvopic appears to have the best possibilities but no reliable data is yet available.

11. The thought was expressed that resistance to torpedo damage was more important than resistance to air bombing because of the difficulty of repairing under-water damage. Tests have been conducted on one-ton blocks at 1/25 scale and the crater sizes previously reported are based on these tests. Additional tests have been completed within the last two weeks and test data will be available shortly. The British representatives feel that additional tests at 1/10 scale are necessary and will suggest that the committee undertake such tests possibly at the Proving Ground at Arco, Idaho. Reference was made to the comment in one of the British reports that pycrete had 1/3 the resistance to penetration of the best reinforced concrete. Dr. Perutz stated that this was an error and should have read the best plain concrete. It was agreed that the comparison was with 2500 p.s.i. compressive strength.

12. The rate of heat transmission was stated as 0.04 B.T.U. per hour per degree Fahrenheit per square foot of surface.

13. The British representatives feel that the trial section should be 200' long and of full sized cross section. It was agreed that Mr. Rivett would prepare a suggested test program for the trial section stating further the specific objectives of the test which will enable the committee to decide whether it should be a full sized section or a reduced model section.

W. H. SMITH.

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Combined Operations Headquarters,
1A Richmond Terrace,
Whitehall, S.W.1.

PRINCIPLES OF CONSTRUCTION OF LARGE FLOATING AIR BASES.

I BASIC REQUIREMENT. LARGE FLYING DECK.

The functional requirements of a large floating air base impose definite conditions limiting the types of structure, the materials and the methods of construction that are available. The primary consideration common to all types of air bases is the maintenance of a sufficiently large flying surface. Once the size of a carrier is exceeded, the size of the flying surface will approximate to that required for the runways of land aerodromes rather than the decks of existing aircraft carriers, as, even with a speed of fifteen knots, there is only a reduction of about 35% in the lengths required for take-off and landing. According to whether it is required to fly fighters, fighter bombers or bombers, the lengths required are of the order of 1,000 - 2,000 or 3,000 - 6,000 feet with possible reduction by the use of accelerated take-off and arrester gear.

II RESISTANCE TO ATTACK

For the use of such floating bases in war there is one further fundamental requirement. They should not easily be sunk or so damaged as to be operationally useless, as they cannot rely on speed to avoid attack from torpedoes or aircraft. The degree of damage which can be tolerated in different cases of attack will differ according to the particular strategic requirements of the floating base. In some cases it will be sufficient to remain afloat and in operating condition for a few critical hours during an attack. In others, carrying out longer term operations, temporary damage can be accepted as long as the vessel can be kept seaworthy and operationally fit for long periods. In the cases where the bases are expected to house planes, as well as to fly them from the deck, it may be necessary to have protected docks.

III BASIC DESIGNS

The maintenance of the large floating platform even of the smallest of the dimensions indicated involve problems of naval construction, propulsion and navigation of a different order of magnitude and consequently largely different in kind from those of the largest vessels at present constructed. The primary requirement is to support the platform and maintain it in a condition suitable for flying in roughest waters in which operational flying is possible. This seems to mean effectively a freeboard of about 50 ft. Under special conditions when fighter cover is required, for strictly limited times, for landings in calm weather this freeboard can be lowered.

There are four methods by which the flying platform can be maintained at any level above the sea.

(1) By making the platform the deck of a ship of more than usual size. This is the simplest solution, but naturally leads to the greatest amount of construction and consequently to the greatest call on materials, on labour and on time. The unusual size of such a ship might make it difficult, if not impossible, to build it of the conventional material, steel, even if available, in a short enough time, and it was to meet this difficulty that the frozen pulp material known as Pykrete was developed and the original HABBAKUK (now HABBAKUK II) was designed. (see figures A and B) Subsequently it has been proposed to build a smaller Habbakuk III)

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(2) The platform can be supported by an open framework on a raft. This uses far less material than (1), but is open to severe objections on the ground of the difficulty of constructing a raft, say of steel or any other buoyant material which will not break up under wave action and at the same time not possess a very large resistance to movement through the water. (Figure C)

(3) By supporting the platform on one, two or more pontoons which might in this case be actual ship sections or wooden floats. This, though using more material than (2), is not open to the same objections with regard to wave resistance. The types of floating aerodromes proposed here, HABBAKUKS I and III are variations of the pontoon type. (Figures D, E and F)

(4) By supporting the platform on submarine floats. This is the Creed type Aerodrome and has the advantage that the wave stresses are far less than on any of the first three types. On the other hand, on account of the small amount of area cutting the water waves, the tendency to roll is considerable. (Figure G)

- 111 -

On examination, types (1) and (3) correspond to HABBAKUKS II and I-III respectively, ~~two first for the heavier (bumbers) and the other two for the lighter (floaters) bases.~~

IV MATERIALS

The size of these types of vessel, together with the requirements for the resistance of enemy attack are such that it is necessary to consider materials and the methods of construction in addition to those normally used in modern ship building. As the function of the vessel is primarily to support the platform and not to hold a cargo and to provide living and fighting space, the most important function of the underwater part of the vessel should be buoyancy under conditions of attack. Ideally for this purpose the underwater portion should consist of solid buoyant material which cannot therefore fill on holing and should not waterlog. The problem is to find such a material, which, besides being buoyant, is sufficiently strong to resist static and wave stresses, is cheap and easily available in the very large quantities required. The only materials that come into consideration here in a practical way are wood and ice.

Wood has the advantage of strength and of being a known material, but it is not available in indefinite amounts and it has a tendency to waterlog that is difficult to control.

Ice, reinforced with wood-pulp, in the form of Pykrete*, cannot waterlog, it is available in indefinite quantities and comparatively small cost in power or labour, but it can melt and, therefore, requires an insulating skin and refrigerating machinery. Its strength is not as great as wood and its floatation margin is small.

Steel construction has the advantage of using known technique and enabling design to be made in a calculated way, but it is the most important strategic material, and its use is bound to compete with other naval construction. Further in order to arrange for resistance to torpedoes and bombs a very high degree of sub-division is necessary involving considerable additional labour in construction.

* See notes on Mechanical Properties and Manufacture of Pykrete at Annex V and VI.

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The particular choice of material need not be the same for floating bases with different functions. Where building to resist stresses is the most important, as in a fast vessel, the over all size can be smaller and steel is clearly indicated. Where the size is the predominating character and there is a further requirement for protection from bombs and torpedoes, Pykrete seems to be the only material at present available. For intermediate sizes where neither speed nor durability is required, wood would probably be suitable. Wood could also be used for the larger types, but the problem of supplies and even more the labour for felling would seem to make this impracticable.

Various other materials have been suggested from time to time, but have not been adequately investigated. Concrete itself has little advantage over steel, for owing to its intrinsic heaviness, it will also need compartmental structure, involving much labour and achieving a result lacking in the safety features which steel can give. Bubble concrete is still too heavy to be self-floating, but it is possible that a more elaborate development of bubble concrete might solve the problem. The use of resin bonded waste materials such as sawdust is also a promising line of investigation, but hitherto the lack of resistance to wetting is a serious disadvantage.

In general, while it may be preferable to use steel for the construction of vessels which are wanted immediately, it is very unlikely that a fleet of HABBAKUKS can be built without using wood, or, for the larger types, Pykrete.

V PROBLEMS OF DESIGN OF VERY LARGE VESSELS

Whatever the material used for construction, large floating air bases have raised new problems in ship design on account of their very great size. These problems may be taken in order as:-

(1) Hydrostatic stability

(2) Resistance to waves

(3) Propulsion

(4) Navigation

1. Hydrostatic Stability

Except in the simplest cases, where the floating base has a normal ship hull form, the construction of floating bases is entirely unorthodox, though some of the forms proposed resemble those used by primitive tribes today, e.g. Catamarans and outrigger canoes.

The existence of a platform high above the water makes it necessary, to preserve transverse stability, to have a wide or deep supporting float. The wide float for the raft or multiple pontoon type gives stability at the cost of very much increased resistance to movement through the water. Deep floats involve greater wave stresses and may increase the draught of the vessel to values much larger than those normally met with, up to 150 feet, thus raising quite new problems of construction and repair. The third method based on the principle of the Creed Seadrome avoids such stresses and achieves stability in waves by keeping the main floats below the depth of greatest wave disturbance, but it does this by maintaining a somewhat narrow cross section at the water line and is therefore liable to serious, slightly damped, rolling and pitching.

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2. Wave Stresses

All large vessels of 500 ft. or over are exposed to larger wave stresses than small vessels which can ride all waves which would be large enough to damage them. In calculating wave stresses for large vessels an even keel can be assumed and these stresses produced by the wave will be roughly proportional to the product of the length and height of the wave and beam of the ship at water line. Unfortunately, we have little adequate data about these large waves, especially in seems where they are known to occur only after severe prolonged gales. But it has been assumed that for the Atlantic they should be taken as 1,000 feet long and 50 feet high, but in the Pacific even larger waves may be expected, running up to 2,000 feet long and 70 feet high. The stresses are greatest for the simple ship forms such as the HABBAKUK II and least for the Creed type. In all cases the calculated stresses can be met in the design.

For floating bases(HABBAKUK I) only intended to provide fighter cover landings and intended to be used only once, resistance to the largest waves is not required as they will not be used under these conditions.

3. Propulsion

The propulsion of a very large vessel except at low speeds is difficult to achieve by conventional methods. Simply to scale up engines and propellers would give rise to vast engineering problems,as even at present they come near the size capacity of steel and metal works. The only alternative is to multiply the number of ultimate propulsive units and to make and design the vessel so they can operate most effectively. This is a naval construction problem of a somewhat unusual type, and tank experiments will be needed before it can be satisfactorily solved. In the case of the Pykrete vessel, HABBAKUK II, additional difficulties arise in the placing of the conventional propeller shafts and propellers in material which is liable to slight but continuous disturbance due to creep. This difficulty can be met by attaching complete propulsion units, motor plus propeller to a number of nacelles situated along the sides of the vessel and a similar solution might be adopted to other forms of vessel.

The power of the propulsion units depends naturally on the speed required, being roughly proportionate to its cube. The difficulty of getting a fast vessel of this size is not that the power would be so large, relative to the size of the vessel, but that the absolute size of the engines would be so great. To drive HABBAKUK II at 20 knots would require a power of 350,000 S.H.P. approximately, and HABBAKUK III[C] at 30 knots would require a power of 160,000 S.H.P. approximately. Such power units, apart from the difficulty of obtaining the necessary engines, all in short supply, would seriously compromise the possibility of getting security against enemy attack as the engine rooms and fuel would take up such a large proportion of the available space and lower the weight of protection that could be carried. Within these limits, however, which means effectively for HABBAKUK II a speed of 7 knots with a power of 50,000 S.H.P. approximately, for HABBAKUK III[C] a speed of 15 knots with a power of 25,000 S.H.P. approximately, the value of the speed attained has simply to be measured against the other priority requirements for engines. The need for high speed in such vessels is not as great as might appear because their striking power depends rather on the speed and range of the aircraft they carry than on their intrinsic speed.

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4. Navigation

The navigation of the vessels of the size discussed involve entirely new problems, especially if they lack speed. The turning of such a vessel or its maintenance of its direction in a cross wind would, in conventional methods, require the use of enormous rudders, the larger because of the lack of speed. Any such rudders would be difficult to make, move, or even to hold in place and it would seem that here a radical change would have to be made in steering, perhaps by the use of either varying the speed of the propellors, separate rudders attached to each nacelle or special propulsive units set athwart for steering. It should be remembered, however, that owing to their very size the bases will never be required to enter narrow waters, much less have to manoeuvre in them. Their chief difficulty will be to keep head to wind for flying purposes and to avoid drifting on to a lee shore. The first might be achieved by means of some equivalent of a sea anchor, possibly an auxiliary tug. The second is not so great a danger as it might appear for even with the heavier and less powered type, HABBAKUK II, the draught is so great that the drift under worst conditions is only about 1/6 of the wind speed and except for hurricanes is well within the power of the engines to hold. For the type without engines navigational problems are those of normal tug practice, but on an extremely large scale and much tank experimentation is necessary before the design which can be relied on to behave well under tow even in a heavily rough weather can be found.

One problem of considerable apparent difficulty is the mooring of large air bases for, owing to their size and height above the water, they will experience considerable wind forces and their deep draught be exposed to heavy current drags. It is calculated that in a full gale tension on the anchor capable of holding HABBAKUK II would be 85 tons, and that of HABBAKUK III 136 tons. These are stresses too great to be conveniently held by any normal anchor that could be carried on the vessel or even to a set of such anchors. It would seem more desirable that for refuelling and repair purposes at base station HABBAKUKS should be attached to a permanent mooring, i.e., to blocks of concrete of the order of 100 tons weight or so. While away from base, the mooring would be required, the vessel being held to the weather by the use of her engines.

VI RESISTANCE TO ENEMY ATTACK

Floating air bases seem most liable to attack by torpedo on moving slowly into position and by air when in position. The most effective form of defence against all these is, of course, counter attack by aircraft from the base itself, but as this will take away aircraft from their primary role, the main defence of the base would be by its own anti-aircraft fire, supported possibly by auxiliary surface craft armed with depth charges. However, owing to the necessarily low speed of the bases they are likely to be engaged more heavily and for longer periods than most ships and particularly when covering land operations to be engaged by land air forces possibly possessing numerical air superiority. Even if that superiority is acquired for only a short period, it is essential that the vessel remains afloat, in operation, and capable of moving under its own power.

The technical requirements for defences fall into two main categories, above and below water. For defences above water in the lighter types reliance is placed on the relatively small damage done by exploding bombs in unconfined spaces of the girder work supporting the flying deck. In such a case the blast of the bomb will hit the under surface of the deck and remove certain portions of it without damaging the beams on which it rests except in the immediate proximity

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of the bank, and this facilitates immediate repair by mat or spare sections kept by for the purpose. A large bomb hit will temporarily knock out a certain area of flying deck, but unless the attack is extremely intensive, owing to the comparative width of the flying deck, this will not necessarily make it inoperative. Temporary repairs should be quick and permanent repair always possible. With the types with armoured deck such as [illegible] II, delayed explosion bombs will produce craters similar to those in land air fields which can be readily filled from the debris on the edge and other material kept near for the purpose. The most serious results of attacks are likely to be on aircraft actually taking off, landing or standing by. On deck, pens may reduce this a little, but they clearly cannot be used over the whole area. The principle will be, of course, to have as few planes on the deck as possible in exposed times of attack, either by keeping them below in the covered deck type, or keeping them operative in the uncovered deck type.

Defence against underwater attack is most difficult in the case of the more conventional types of HABBAKUK III, where there is an open hold which can be flooded, but they will be provided with what is effectively bulge construction and much sub-division, to resist torpedo attack. As designs here have not proceeded far, it is impossible to say what degree of protection can be afforded. A most promising additional protection is furnished by the use of steel sheets or nets for anti-torpedo protection [illegible] the construction of wood or Pykrete [illegible] HABBAKUK I and II), underwater damage is likely to [illegible] But while in both cases Pykrete counter-acts [illegible] its main immediate effect is to increase the pulp cell below the speed of the vessel, in Pykrete there is the danger of melting due to removal of the outer [illegible] This is minimised by the property of Pykrete of forming a self-insulating coherent pulp layer and further melting is checked by a double layer of refrigerating pipes.

The effect of naval gunfire is likely to be extremely small. The heavy naval shell is likely to go all the way throught the HABBAKUK I and III structure and should they explode inside owing to their small charge, they will do little damage, except in engine rooms unless armoured. Light shells will be ineffective.

For floating bases made of wood there is an additional danger of fire. As long as complications of living quarters, stores, etc. are not too much developed, it should be very difficult to set the main framework on fire, as experience has shown that heavy wooden structures are very difficult to ignite and need to start a big blaze before it can spread. HABBAKUK III is less susceptible to fire, as HABBAKUK II intrinsically fireproof, as Pykrete is not inflammable.

The chief danger of underwater attack on all types of bases is to the propulsive and steering machinery. This can be met most effectively by duplication or multiplication of parts as is proposed [illegible] In any case multiplication will be of value [illegible] in the navigation of such large vessels.

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VII POSSIBILITIES OF CONSTRUCTION.

With vessels of the size of those contemplated, questions of harbouring and docking, not normally thought of in conjunction with ship building, become of critical importance. HABBAKUK II cannot fit any existing dock or basin. The design of HABBAKUK I and III does however, allowsthe central hull to be made in an ordinary or floating dock, the outriggers lying over the sides. Alternatively, the hulls of the vessels could be built and launched in sections and joined together, the superstructure and dock being built afloat. Habbakuk III can be made in a large dock (150' x 1500' HABBAKUK II, however, has to have its hull of insulation and Pykrete built in situ and floating, and this requires a large area of sheltered water which is in direct communication with another area in which there is sufficient depth of water to allow for the draught of 150 ft. with clear passage to the ocean. The effect of these limitations are, that while HABBAKUKS I and III can be built in moderately protected water near an existing port, HABBAKUK II can only be built in a relatively small number of fiords. Fortunately such fiords are found largely in areas with considerable winter cold for making the necessary ice. .. far larger choice of sites is available if it is decided to make the Pykrete by artificial refrigeration. In all cases there is a requirement for readily available raw materials, power and labour far greater for vessels of the size concerned than they are for ordinary ship-building. Geographical sites for their construction is therefore fairly sharply limited.

Once the construction of the vessels has proceeded beyond the first stages, their own bulk is so large that for the latest stages of construction they may be treated as fixed piers and construction carried on from them bringing materials up in lighters or by special piers. The final fitting can, of course, be done in quite a different area from that of the actual construction.

Repair (except for Habbakuk III)

The problems of repair are, however, of an entirely novel character. Repairs over or near the water line in all vessels can be made in any reasonable quiet water, but underwater repairs on the job will always be difficult. In the case of HABBAKUK I and III, it would probably be simpler to cut away damaged sections altogether and to replace them by new ones rather than to try and repair damage on the site. Repairs on HABBAKUK II cannot be effected in this way. Considerable thought has already been given to the underwater repair problem. The vessel has been designed to allow the removal of the damaged outer layer of insulation in sections, its replacement by a new layer and the freezing of the intervening spaces by special cooling pipes. This method has, however, to be tested out on a large scale before its difficulties can be overcome and the problem of meeting similar damage on the bottom of the vessel, although unlikely to occur, has yet to be developed.

VIII GEOGRAPHIC RANGE

The geographical range in which the basins can be used is primarily determined by their draught. The types based on motion floats or pontoons or sections have a draught of 30-40 ft. and, therefore, can go in anything but the smallest water. They would, however, be extremely difficult to navigate in any channel, such as an estuary because of their size, their relatively poor manoeuvrability and the difficulty of getting off once aground. HABBAKUK II made of Pykrete, owing to its massive construction, has a considerable draught, up to 150 feet, and consequently is effectively limited in its range to oceanic waters. It is unable, for instance, to get on to much of the

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Continental shelf of Europe, including part of the North Sea, or into the Bering Sea. There is little, however, of the Pacific that it cannot pass through. Generally speaking, all types of such vessels will be endangered if among islands or on a rocky shore in violent storms, and their normal range of operation will be 100 miles or so out to sea.

For repairs and renewing of stores, etc., deep quiet waters will be needed, but such are in fact found in very large sections of both the Atlantic and Pacific coasts.

HABBAKUK II, owing to its Pykrete construction, is affected by the temperature of the water and also, to a lesser degree, by the air temperatures. It has been designed to endure indefinitely the hottest temperatures likely to be met in any ocean, but in doing so it must naturally use a much larger proportion of power for refrigeration. Thus, for use in the North Pacific with a water temperature of 52 degrees, 2,000 h.p. would be used for refrigeration, but for use off the Solomons with a water temperature of 83 degrees, 4,000 h.p. would be used.

IX SUMMARY

The principal problems of construction of large floating bases are those directly connected with the large size of the vessel, determined by the size of the flying platform it supports. Large size implies either the use of very large quantities of steel, or the use of unconventional but cheap and abundant materials, such as wood and ice for construction. It also implies changes from conventional design of the vessel and of its propulsive machinery. A whole set of other problems arise in regard to the navigation and range of these bases. All these problems are serious, but none seem out of range of solution in the near future, as means of solving them by calculation or the use of models are to hand in most cases, while in the remainder, experimental sections of the vessels will give the answer. It may turn out that when these tests are made, some of the designs put forward at this present stage will be found to be impracticable or relatively uneconomic, whilst in the course of the investigation new and better methods not hitherto discussed may emerge.

14th August, 1943.

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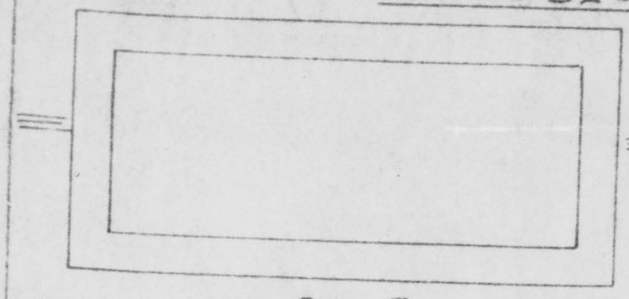
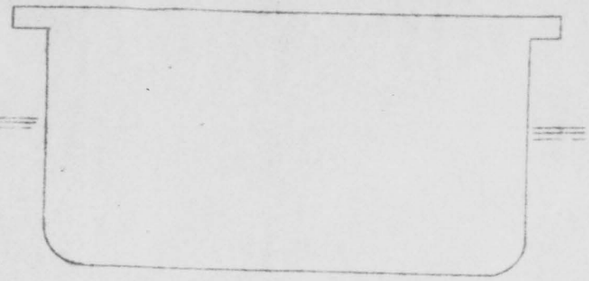
ANNEX. I

BASIC DESIGNS. HABBAKUK.



— FIG A —



— FIG. B. —

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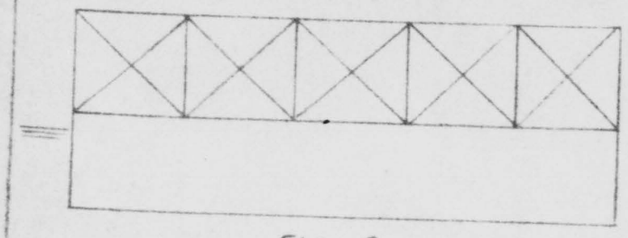

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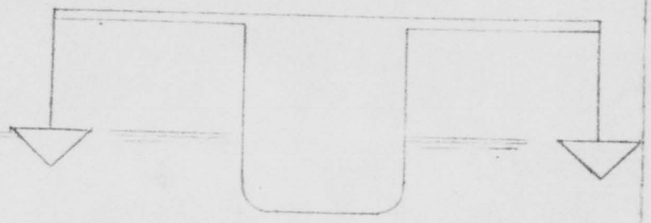

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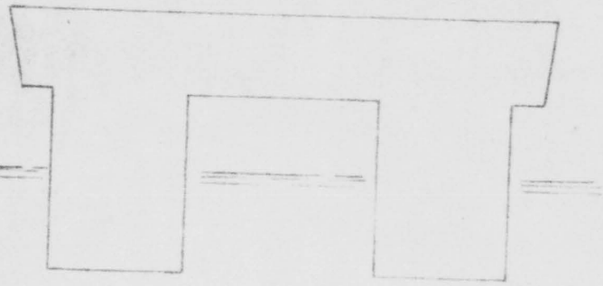

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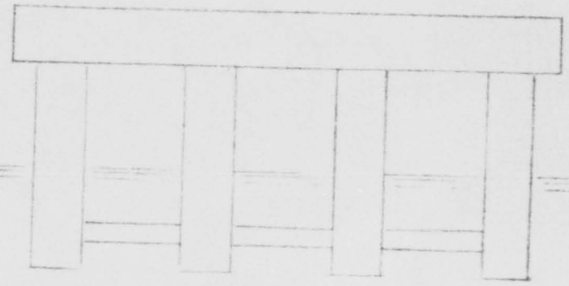

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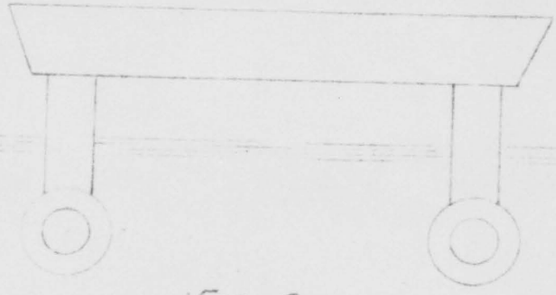

— FIG G —

NOT TO ANY SCALE.

CHATEAU FRONTENAC.
AUGUST 1943.

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ANNEX II

HABBAKUK I - Brief Description

Requirements

The governing factors in the design of this semi-mobile, advanced floating landing ground for fighter aircraft are, that it must be produced rapidly, cheaply and without interfering unduly with other war commitments. Certain limitations as to strength and durability can be accepted, provided that the vessel will stand up to one operation, while self propulsion is not essential as a speed of 2-4 knots under tow will meet the requirements.

Design

In view of the above, timber has been chosen as the medium as fundamentally it is in large supply, it is easy to work, and its inherent properties will assist it to withstand a great deal of punishment in an operation before becoming unstable. Briefly, the proposed structure consists of a large central floatation member constructed of bulk timber, from which cantilevers extend on either side to provide the requisite width of superstructure forming the flight deck. Stability is maintained by floatation units attached to the ends of the cantilevers, thus reproducing in outline the essential features of a flying boat.

Propulsion

The calculated underwater resistance of the vessel is 43.1 tons at 2 knots. This is well within the capabilities of two 3,000 H.P. tugs, each with a pull of 36.3 tons at that speed.

Manoeuvrability

The one requirement in this respect, and it is a vital one, is that the vessel must remain head to wind once on station. Theoretically a sea anchor should serve the purpose, but in practice it may prove necessary to supplement or substitute the latter by one or two tugs according to weather conditions. Tank tests will show whether it would be expedient to incorporate one or more rudders in the design, particularly to counter yawing on passage.

Seaworthiness

The structure has been designed to withstand wave stresses set up by a wind of force 8 (i.e. wave 625 ft. long and 27 ft. 6 in. high). Owing to the abnormal length of the righting arm presented by the buoyancy floats at the end of the cantilevers, the vessel should prove exceedingly stable, and by virtue of its overall length, subject to a minimum of pitching.

Protection

A 10 ft. wide gangway is provided, running the full length of the vessel on either side, which could be used for siteing any number of oerlikon guns or other forms of A.A. protection. The design of the superstructure is open and relatively light, thereby reducing serious damage from bomb blast to a minimum. Normally, large timber structural members are most difficult to ignite, but the fire hazard from the petrol and oil soaked deck would be considerable unless some form of light metal sheeting were provided, particularly where aircraft were serviced.

The effect of underwater attack would be localised in view of the great thicknesses and areas involved, consequently the vessel would be capable of withstanding a great many direct hits before becoming in

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any way unstable. A certain amount of protection could, however, be provided by nets suspended from the floats.

Aircraft

No provision is contemplated for stowage of aircraft below deck, as simplicity in all features is contrived at in the design. On Fleet Air Arm standards, however, it has been calculated that it would be possible to stow and operate up to 200 fighters on the deck. (Note: This is very considerably in excess of normal R.A.F. practice.)

Equipment would have to include arrester gear, while rocket assisted take-off would be advantageous, although not essential. Fuel supply is proposed by means of pumping through flexible hoses from attendant lighters.

Accommodation

Space for personnel and stowage of stores and equipment is almost unlimited as a deck could be formed below the flight deck, although spaces would be restricted to units of 20 ft. wide, between trusses.

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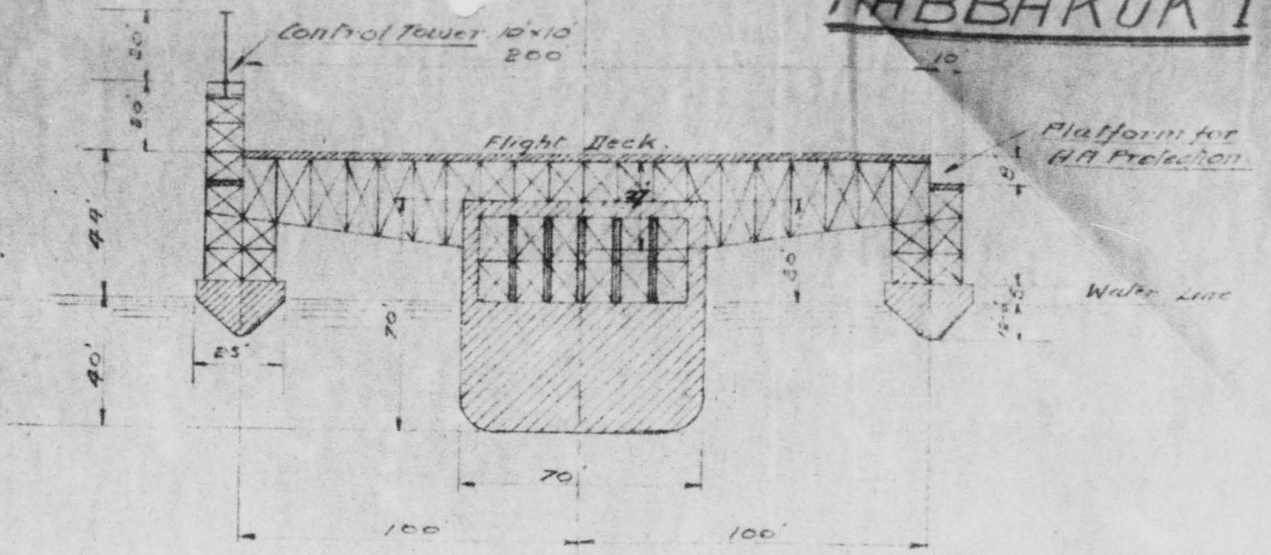
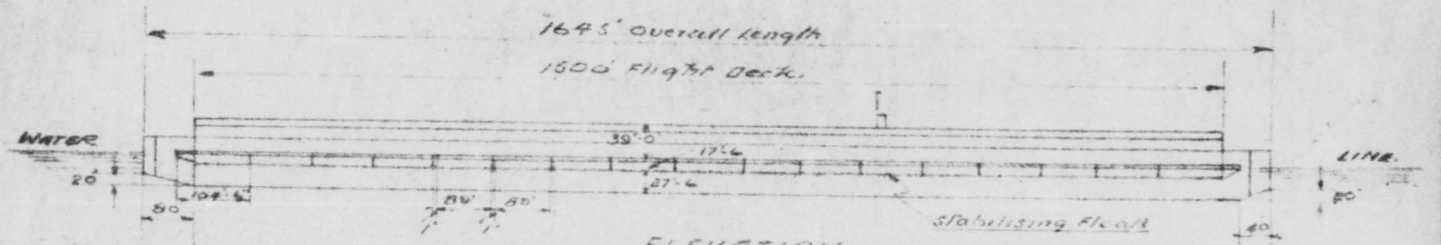
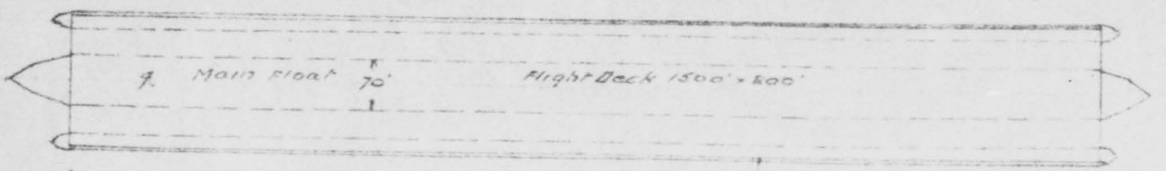
HABBAKUK I



CROSS SECTION
SCALE 1" = 40 FEET



ELEVATION



PLAN
TO SMALLER SCALE 1" = 200 FEET

SUMMARY OF ESSENTIAL FEATURES

MATERIAL	TIMBER
LENGTH	1500 FEET
BEAM	220' (Flight Deck 200)
FREEBOARD	44 FEET
DRAUGHT	40 FEET
DISPLACEMENT	100,000 TONS
SPEED / POWER	TWO 30,000 H.P. TUGS TOTOW AT 2-4 KNOTS
COST	APPROX £1,000,000
EARLIEST DATE FOR DELIVERY	11 MONTHS FROM ORDER

CAPACITY
APPROX 200 SPITFIRES
OR 400 SEAFIRES
(Stowed on deck)

RESISTANCE TO -
TORPEDO — V. GOOD
BOMB — GOOD
FIRE — FAIR

CHATEAU FRONTENAC
AUGUST 1943. E46

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ANNEX III

TECHNICAL DESCRIPTION OF THE HABBAKUK II
STRUCTURE

From the constructional point of view, Habbakuk II is a vessel of 2,000 ft. length, 300 ft. beam, with an overall depth of 200 ft. and a draft of 150 ft.

The main structural material is Pykrete, and the essential structural principle of the whole hull is that of a massive hollow girder.

The Pykrete is protected from melting and erosion by an insulating skin, tough enough to withstand normal weather conditions and any battering which it is likely to receive from the sea. This skin also reduces the transmission of heat from the outside to the surface of the Pykrete to an approximate level of .035 British thermal units per hour per square foot of surface area per degree Farenheit difference in temperature.

To maintain approximately 50 ft. freeboard and thus render effective air bombing operations possible, it was necessary, although the Pykrete is self-buoyant, to form a large internal cavity, which would raise 25 per cent of the hull above still water level.

The central section of this cavity is used for engine, crew and machine shop space, whilst other sections are available for tankage and similar requirements, but the main voids are simply filled with material or frame-work, having a total overall density per cubic foot of the whole void in the vicinity of .5. The function of this construction is merely to absorb the loads formed by the underwater pressure on the bottom of the hull, and those produced by supporting the protective deck, and to remove the danger of flooding from any leak in the hull.

Throughout the construction 40 ft. thick bottom, walls and deck of Pykrete are provided which will give the whole interior of the structure complete immunity from any present known form of air or underwater attack.

The bomb-resisting qualities of Pykrete are assessed, as the result of experiments, at approximately 2½ times less resistant than the best reinforced concrete, and so far, these expectations have been justified by experiment. The extent of any torpedo damage will be a crater not more than 3 ft. deep and about 20 ft. in diameter. Bomb damage, while the crater may be slightly deeper owing to better penetration, will be of the same order.

The main propulsion is formed by a large number of widely spaced electric motors in pressure hulls. These are powered by a series of Diesel electric generating sets carried deep in the main structure, and are believed to be capable of providing a speed of about 7 knots, and the required degree of manoeuvrability.

The complete elimination of a whole propulsion unit by enemy action will thus have a total effect on the propulsion available of less than 4%, and the breakdown of an entire Diesel electric generating unit will only result in an efficiency loss on the total output of about 6%.

The five diagrams which are attached give a general idea of the dimensions and layout of the vessel, but are intended to give a diagrammatic impression rather than to afford a detailed study.

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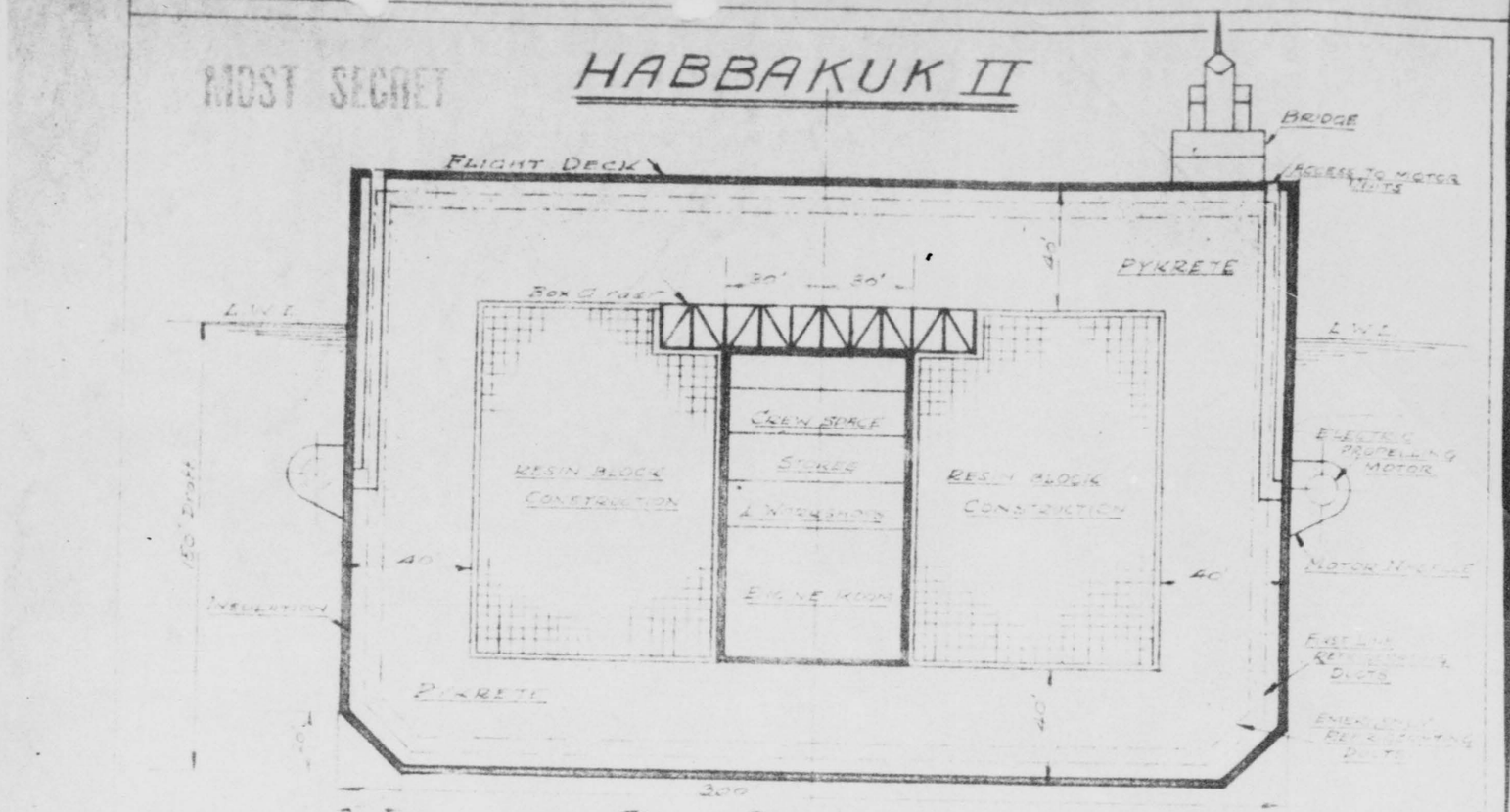
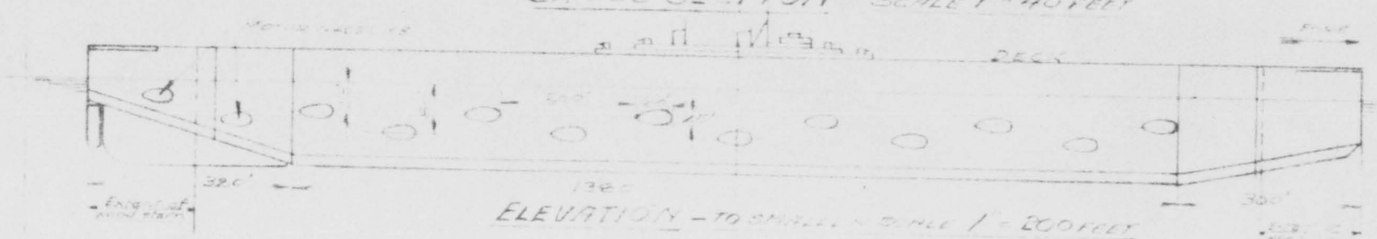
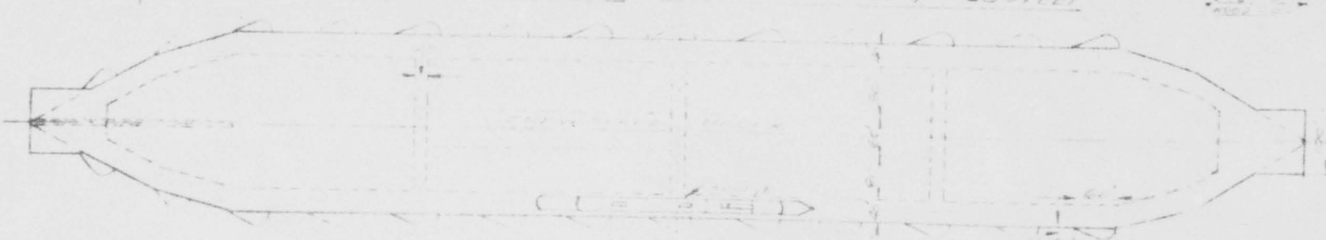
HABBAKUK II



CROSS SECTION SCALE 1" - 40 FEET



ELEVATION - TO SMALLER SCALE 1" - 200 FEET



PLAN - TO SMALLER SCALE 1" - 200 FEET

SUMMARY OF ESSENTIAL FEATURES

MATERIAL	FROZEN PULP
LENGTH	2000 FEET
BEAM	300 FEET
FREEBOARD	50 FEET
DRAUGHT	150 FEET
DISPLACEMENT	1,800,000 TONS
SPEED	5-7 KNOTS
POWER	40,000 HP
COST	APPROX £5,000,000
EARLIEST DATE FOR DELIVERY	SUMMER 1943 IF LARGE SCALE RESEARCH THIS WINTER SATISFACTORY.

CAPACITY:
200 MOSQUITOES OR
100 SPITFIRES (STOWED ON DECK
BUT PROTECTED HANGAR COULD
BE PROVIDED)

RESISTANCE TO
TORPEDO — V. GOOD.
BOMB — V. GOOD.
FIRE — V. GOOD.

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ANNEX IV

HABBAKUK III - Brief Description

Requirement

The requirement is for a large aircraft carrier with a minimum speed of 12 knots, having a protected hangar and capable of operating fighters, fighter-bombers and certain medium bombers.

Design

The scheme envisaged is based on the utilisation of existing shipbuilding methods, equipment and organisation, and its success is largely dependent on the extent to which these facilities can be capitalised.

The concept is that of a standard cargo ship hull for bow and stern, with an intervening parallel middle body built up of a large number of sections, similar to (but considerably stronger than) the midship section of a cargo ship. Above this composite hull a wide flight deck is formed by means of cantilevers, which terminate in stability floats, the whole reproducing in principal the outline of a flying boat or outrigger canoe.

Propulsion

The lines are essentially ship-shape both for the hull and stability floats and underwater resistance is comparatively low, consequently conventional methods can be employed using either two or three propellers. It is considered that a standard destroyer turbine would be suitable, geared down to give a good propeller efficiency. Diesel engines or steam reciprocating engines could also be adapted effectively.

Manoeuvrability

This should prove satisfactory, but to improve performance, additional rudders at the bow and after end of the wing/keel could be incorporated.

Seaworthiness

As in Habbakuk I, the vessel has an exceedingly long righting arm and would prove very stable. Tank tests are in hand, and confirmation will be available shortly.

Protection

Apart from A.A. and fighter defence, protection against aerial attack is afforded by 5 ft of plastic armour over the hangar, fuel tanks and engine room. Anti-torpedo measures include the provision of steel contact planes forming keels to the stabilisers, and also in the extensive subdivision of the main hull.

Aircraft

Below deck accommodation is provided for approximately 25 Mosquito bombers and 25 Seafires, or other types of aircraft covering the same superficial area.

Equipment would have to include arrester gear and rocket assisted take off, particularly in respect of the bombers.

Docking

Investigations are proceeding into the feasibility of adapting existing graving docks or floating docks to accommodate the vessel.

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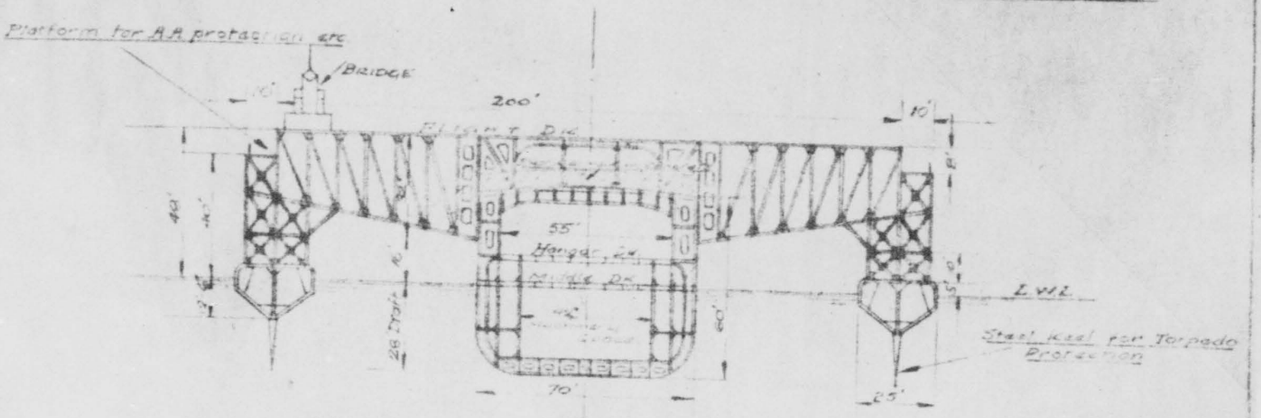
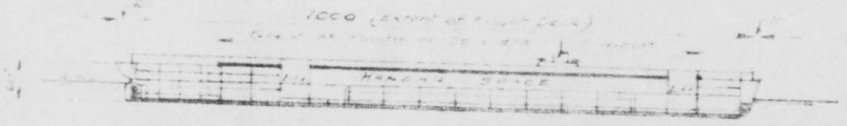
HABBAKUK III c.



CROSS SECTION
SCALE 1" = 40 FEET



ELEVATION TO SMALLER SCALE 1" = 200 FEET.

PLAN TO SMALLER SCALE 1" = 200 FEET

SUMMARY OF ESSENTIAL FEATURES.

MATERIAL	STEEL
LENGTH	1000 FEET
BEAM	220' (FLIGHT DECK 200')
FREEBOARD	48 FEET
DRAUGHT	28 FEET
DISPLACEMENT	55,000 TONS
SPEED	12 - 15 KNOTS
POWER	12 - 25000 HP
COST.	APPROX £1,000,000
EARLIEST DATE FOR DELIVERY	18 MONTHS FROM ORDER

CHATEAU FRONTENAC
AUGUST 1943.

CAPACITY
25 MOSQUITOES AND
25 SEAFIRES IN PROTECTED
HANGAR.
30 MOSQUITOES AND
25 SEAFIRES ON DECK.

RESISTANCE TO:-
TORPEDO — V. GOOD
BOMB — GOOD
FIRE — GOOD

DRAWING CF/3.

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ANNEX IV

MOST SECRET

Approximate Summary of Weights

Total hull structure	16,950 tons
Superstructure and Flight Deck	14,000 "
Stabilising Floats	2,000 "
Load (other than fuel)	2,000 "
Machinery (12,000 H.P.)	850 "
Fuel	1,500 "
Armour	18,000 "
Margin	200 "
	55,000 "

Alternative Design - HABBAKUK IIId

REQUIREMENT - as for IIIc

Design — The alternative to Habbakuk IIIc is a vessel of a more conventional type which is virtually certain of achieving success, as against an unprecedented design whose ultimate success is open to conjecture without long and detailed examination. As in any sphere such insurance can only be gained at the expense of a heavy premium which in this case amounts to doubling the quantities of a vital strategical material as well as that of time and labour.

Propulsion — Total H.P. requirements, 30000 H.P., are slightly in excess of those visualised for IIIc, but the same observations apply, although the ultimate disposition of the machinery may allow for a bow propellor. The efficacy of such a proposal can only be ascertained from Tank tests.

Manoeuvrability — Without the out-riggers, the vessel should prove more manoeuvrable than IIIc although the possibility of a bow rudder is still under consideration.

Seaworthiness — As in I, II and IIIc, by virtue of its length the vessel should be subject to a minimum of pitching and it is considered by some that its behaviour in across sea would be better than that of the out-rigger types.

Protection — Ack-ack and fighter protection still apply, but in this case there is a greater margin in the calculated buoyancy thus permitting a more extensive use of plastic armour. Similarly, below deck sub-division and bulge construction can be carried out ad nauseam in view of the space available, although the torpedo contact plates and nets of the out-riggers would be precluded.

Aircraft — Below deck aircraft accommodation is just double that of Mark IIIc. Arrester gear and accellerator gear would still be required.

Docking — Without the out-riggers far more docks would be available.

Approximate Summary of Weights

Steel. Main hull	38,000 tons
Superstructure	6,000 "
Protection and stiffening	35,000 "
Load	8,000 "
Machinery	800 "
Margin and Ballast	12,200 "
Total displacement	100,000 tons

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HABBAKUK III D

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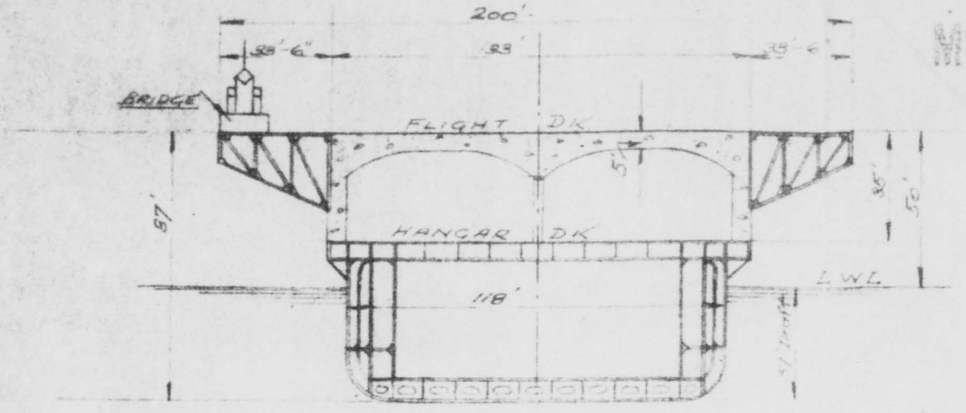
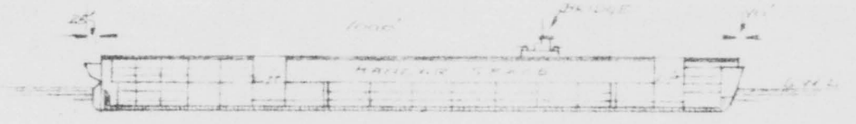
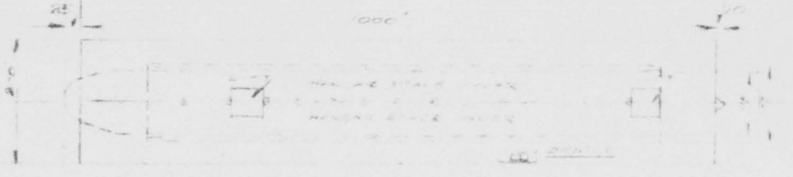


CROSS SECTION
SCALE 1"=40 FEET



ELEVATION TO SMALLER SCALE 1"=200'



PLAN TO SMALLER SCALE 1"=200'

SUMMARY OF ESSENTIAL FEATURES

MATERIAL	STEEL
LENGTH	1000'
BEAM	118' (200' FLIGHT DECK)
FREEBOARD	50' APPROX.
DRAUGHT	37'
DISPLACEMENT	100 000 TONS
SPEED	12-14 KNOTS
POWER	27-30 000 H.P.
COST	APPROX £2,000,000
EARLIEST DATE FOR DELIVERY	2½ YRS FROM ORDER

CAPACITY

50 MOSQUITOES AND
50 SEAFIRES IN PROTECTED HANGAR
30 MOSQUITOES AND
25 SEAFIRES ON DECK.

RESISTANCE TO—

TORPEDO	V. GOOD
BOMB	GOOD
FIRE	GOOD

CHATEAU FRONTENAC
AUGUST 1943.

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MECHANICAL PROPERTIES OF PYKRETE

Figs.32 and 33

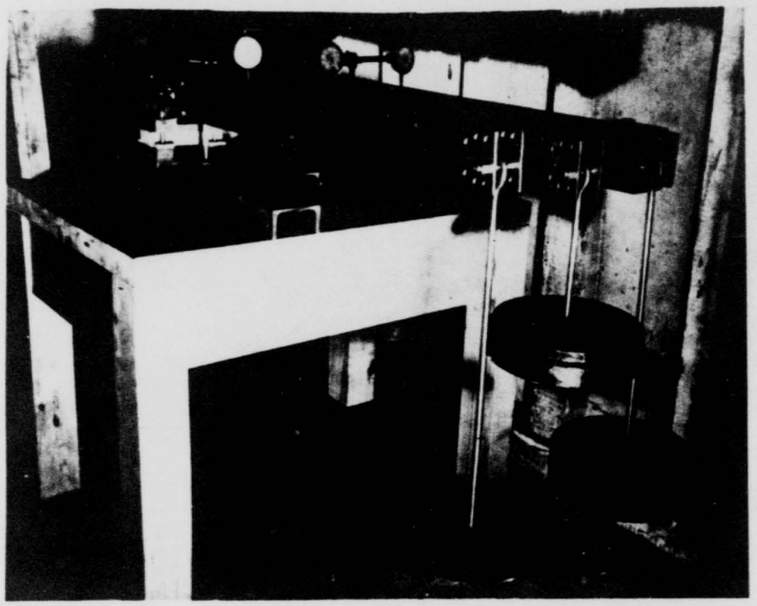

Fig.32. Apparatus for Creep Tests in Shear on Jointed Specimen

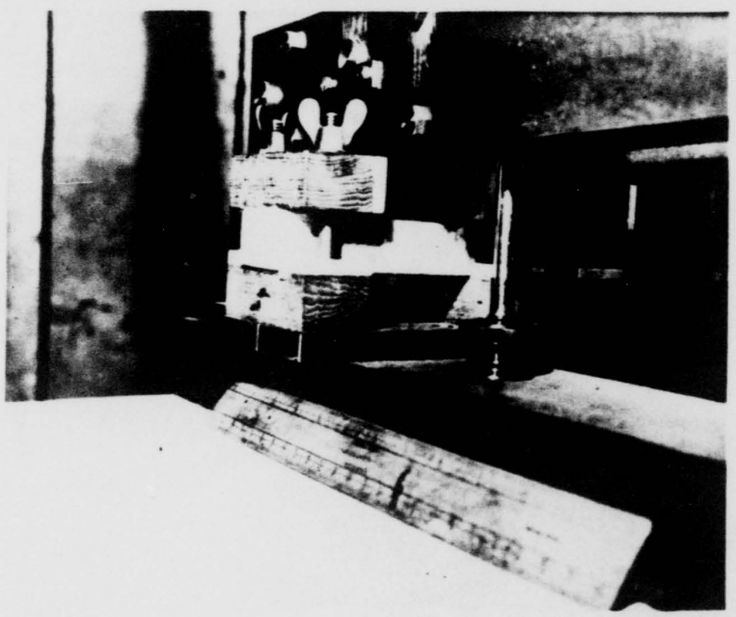

Fig.33. Specimen under Test in Creep-Shear Apparatus.

Date August 1943.

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MECHANICAL PROPERTIES OF PYRETE

Figs 30 and 31

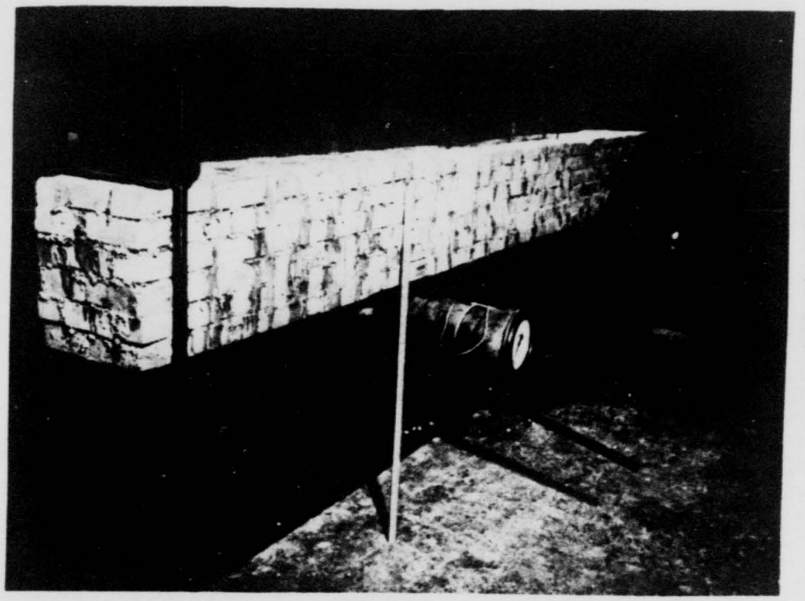

Fig.30. Beam of Small Blocks under Test in Bending.

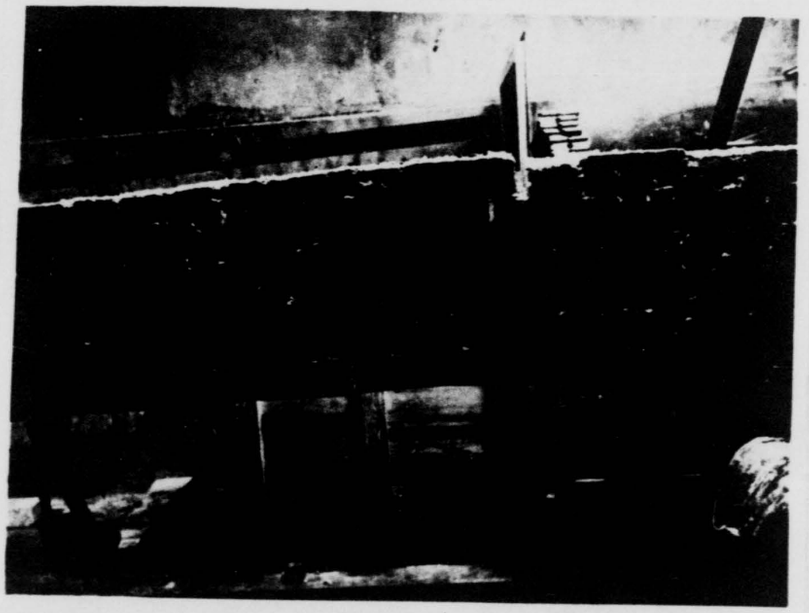

Fig.31. Fractured portion of Beam.

Date: August, 1943.

Reference:

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MECHANICAL PROPERTIES OF PYKRETE

Figs 28 and 29

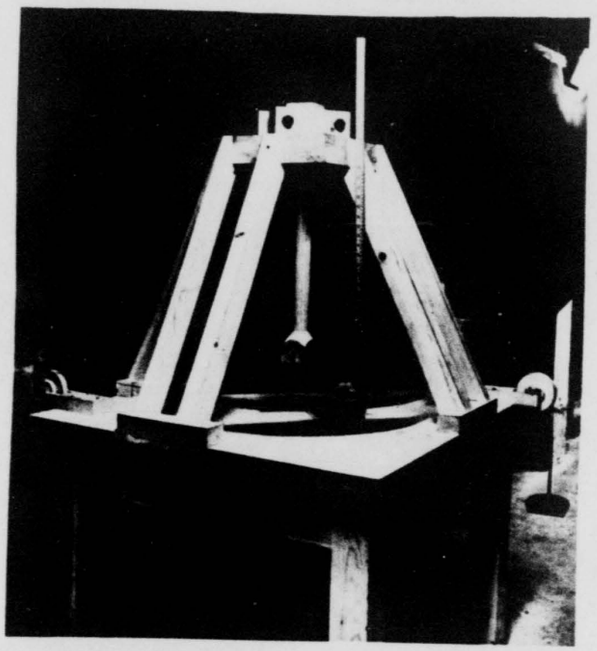

Fig.28. Apparatus for Vibration Tests on 14% Pykrete

Fig.29. Apparatus for Creep Tests in Compression on 14% Pykrete.

Date: August, 1943.

Reference:

Drg. No.: C168/36

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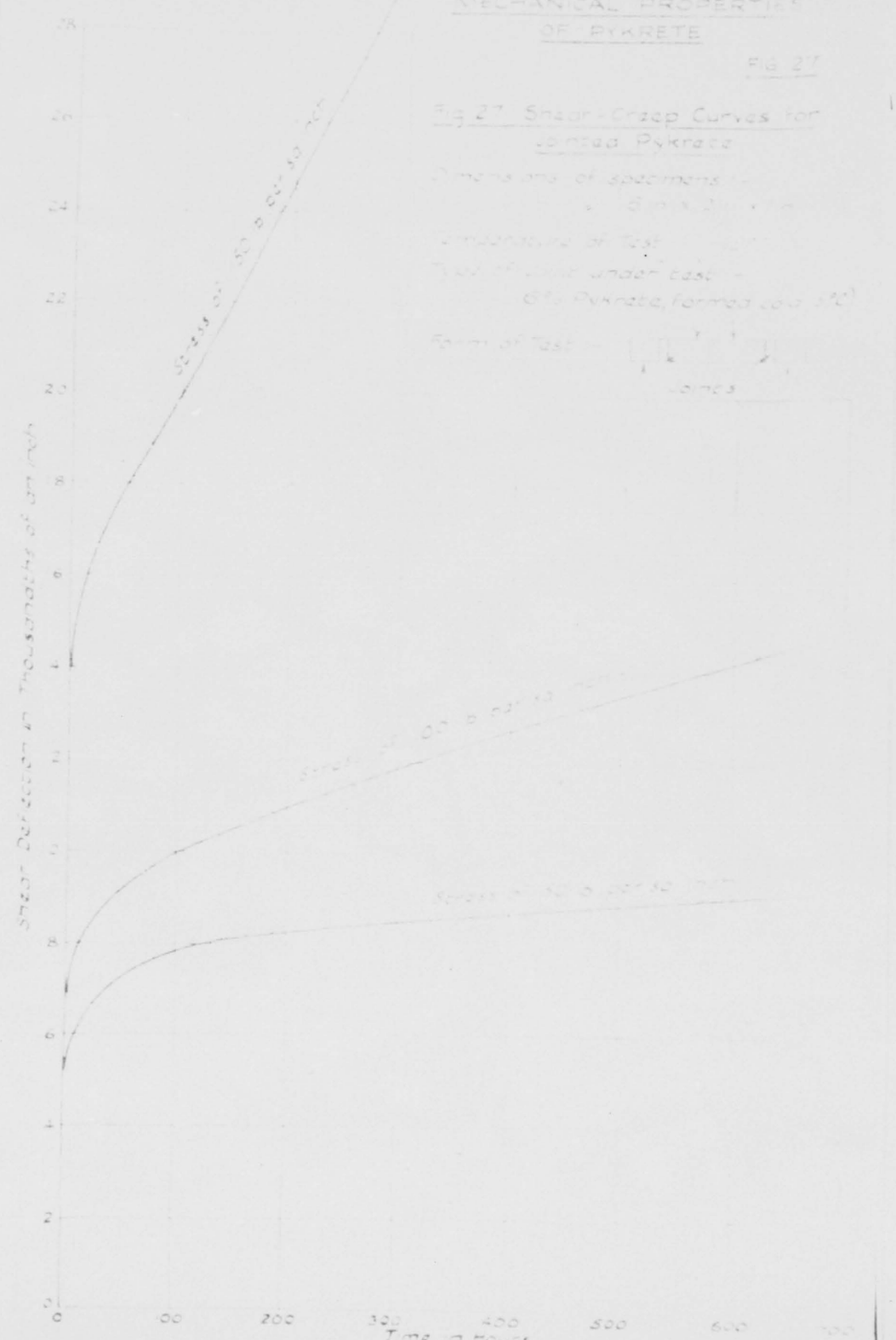
MECHANICAL PROPERTIES OF PYKRETE

Fig 27

Fig 27 Shear-Creep Curves for Ice-Sea Pykrete



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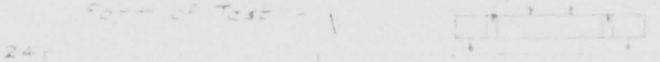
MECHANICAL PROPERTIES OF PYRETE

FIG 26

Fig 26 Shear-Creep Curves for Jointed Pyrete

Dimension of specimens - 6 in x 2 in x 1 in
Temperature of Test - -15°C
Type of Joint used in test - 6% Pyrete, formed Hot (70°C)
Form of Test -



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MECHANICAL PROPERTIES OF PYRETE

Fig 25 Bend Tests on Loaded Beams - Load - Deflection Curves

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MECHANICAL PROPERTIES OF PYKRETE

Creep-Compression Curves for 14% Pykrete (large specimens)

FIGS. 23-24

Fig. 23 Creep-Compression Curves at -10°C.

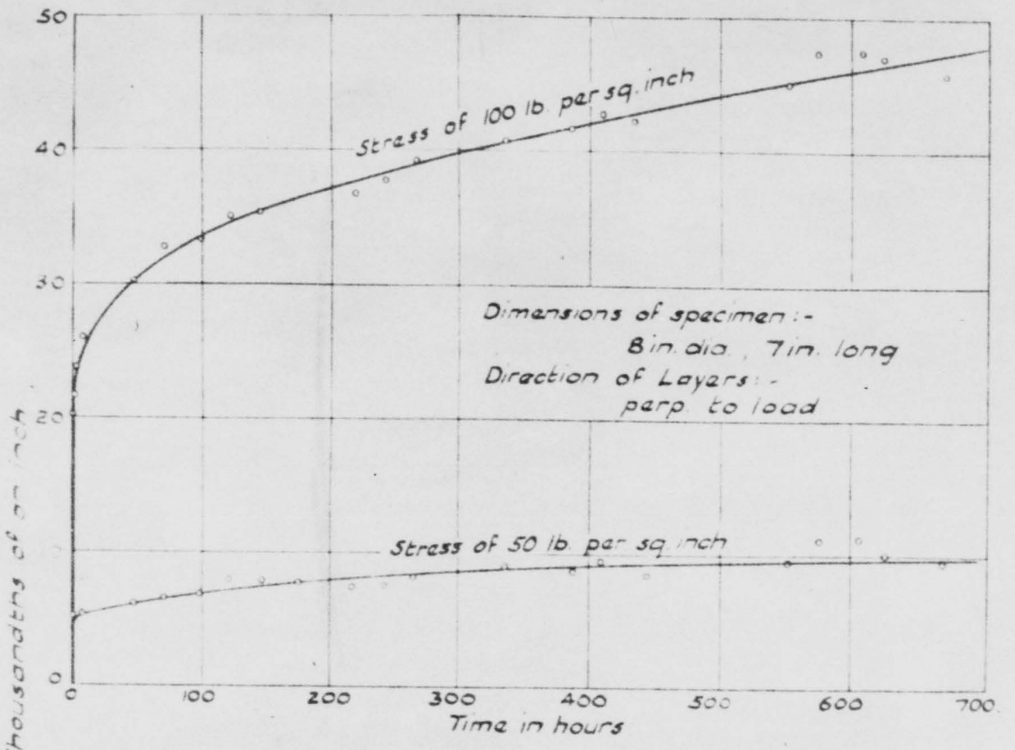
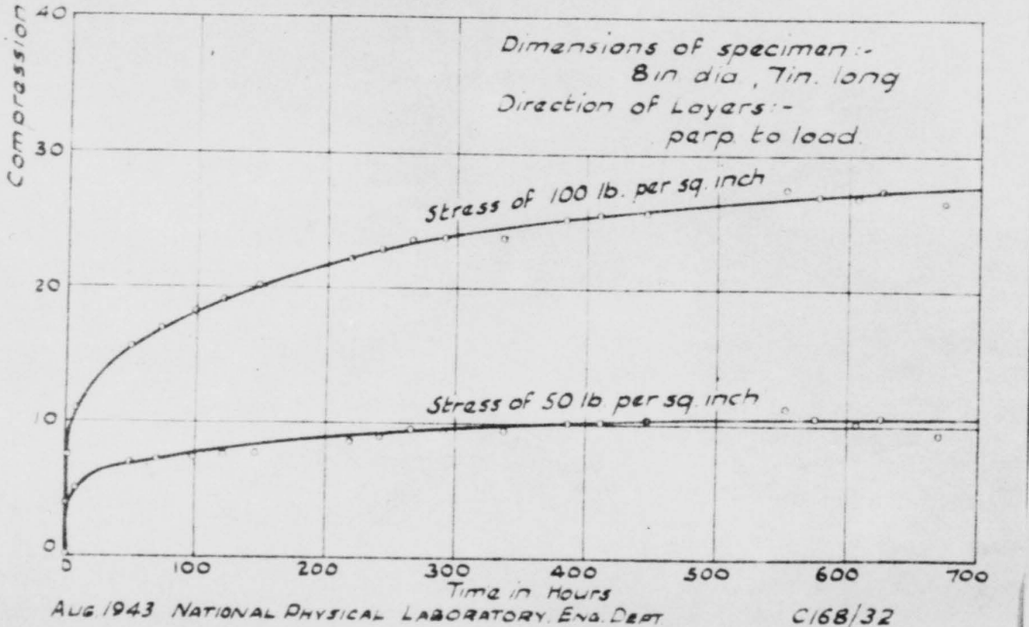


Fig. 24 Creep-Compression Curves at -15°C.



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MECHANICAL PROPERTIES OF PYKRETE

FIG. 22

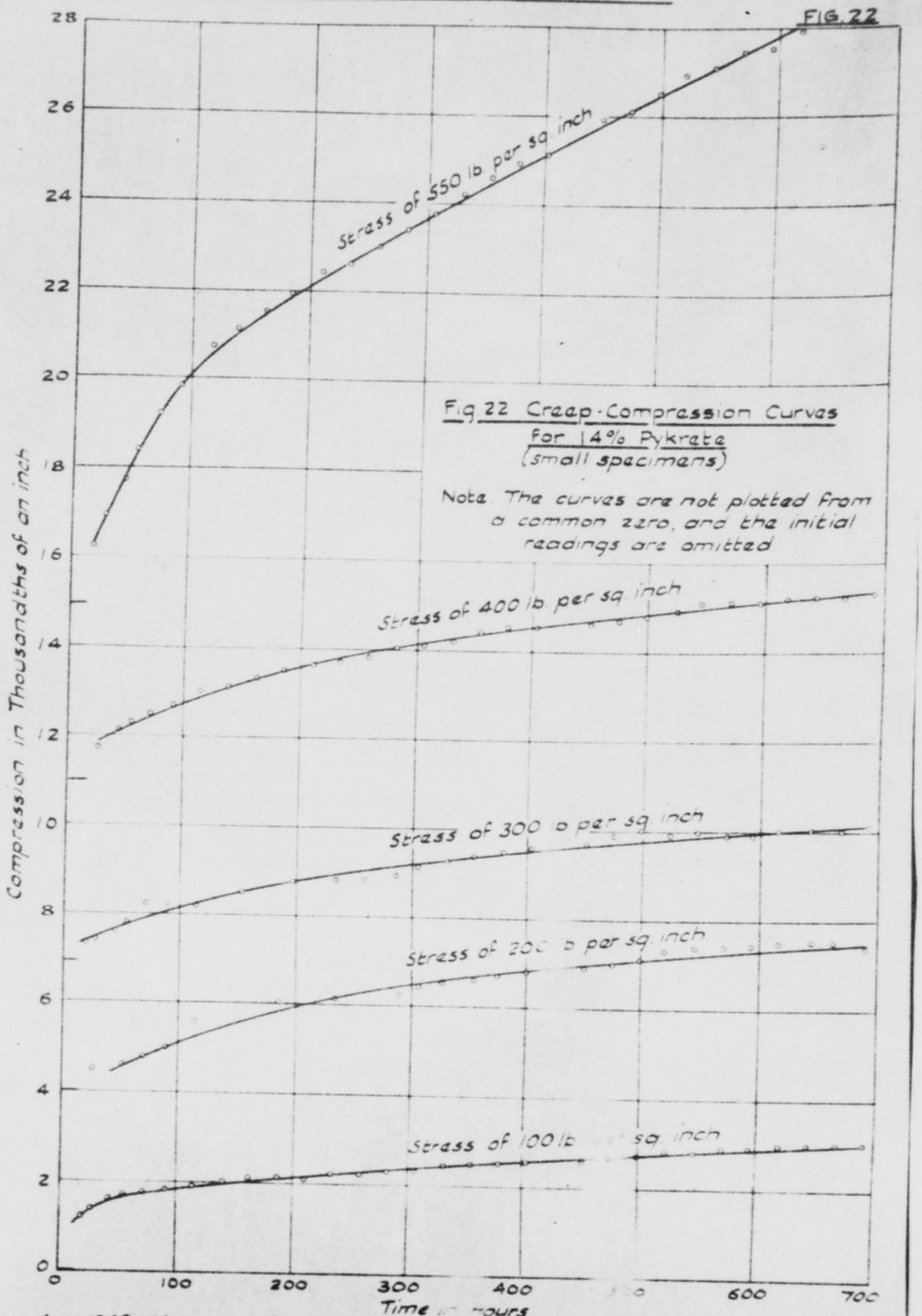

Fig 22 Creep-Compression Curves for 14% Pykrete (small specimens)

Note. The curves are not plotted from a common zero, and the initial readings are omitted

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MECHANICAL PROPERTIES OF PYKRETE

FIG. 21

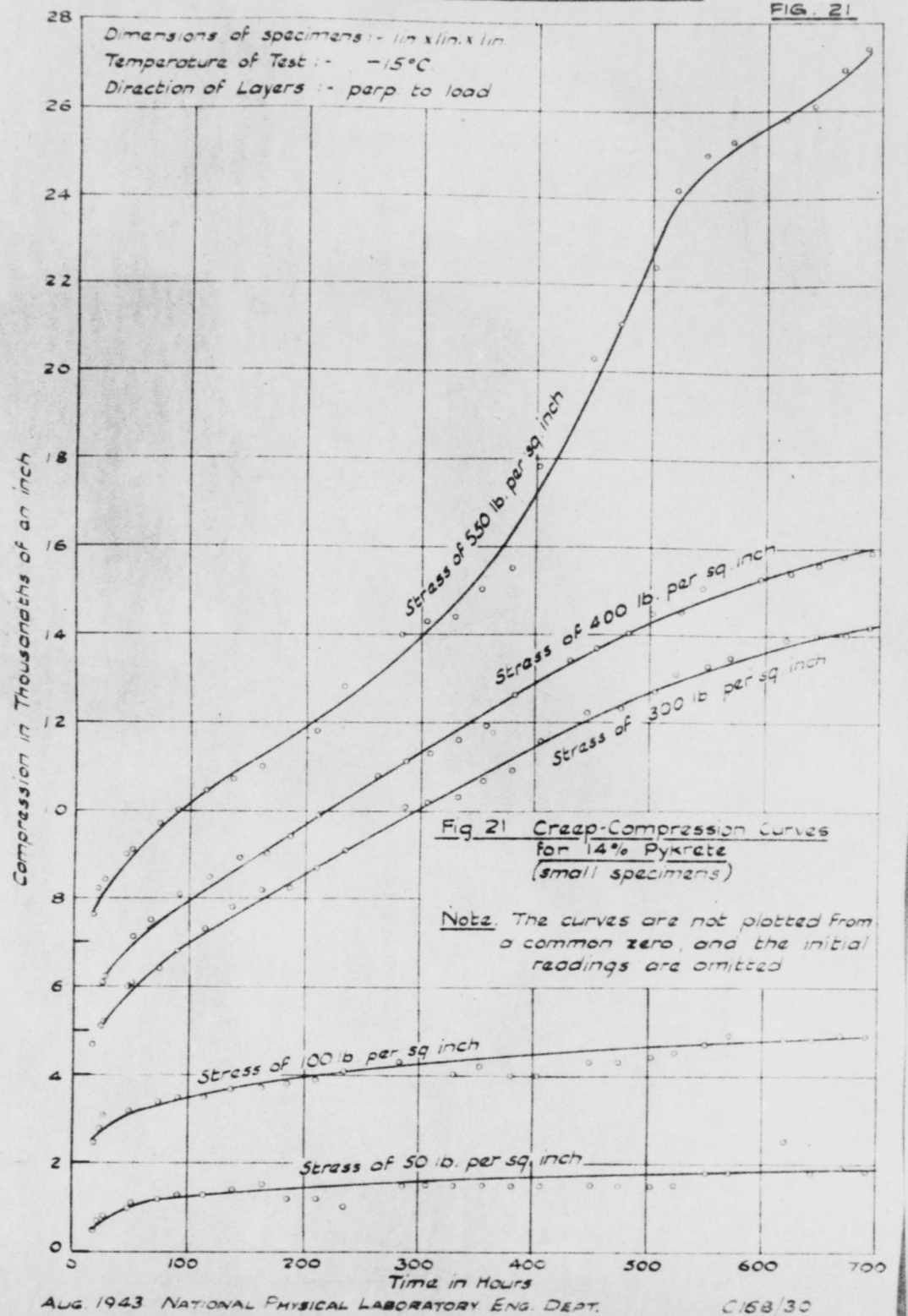

Fig 21 Creep-Compression Curves for 14% Pykrete (small specimens)

Note. The curves are not plotted from a common zero, and the initial readings are omitted

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IV. CONCLUSIONS

In considering the relative merits of the three schemes, time is probably the most important factor. The Pykrete factory should be such that it can be built and completed before the end of November of this year for an output sufficient for one Habbakuk, and that it can be enlarged sufficiently in the following summer to allow for the building of several Habbakuks in the winter of 1944/5.

It is clear that Scheme 2 cannot fulfil the first of these stipulations in view of the considerable size of the refrigerating plant which has to be erected. On the other hand, it might be possible to build a number of such plants before the winter of 1944/5 at Corner Brook and elsewhere.

Scheme 1 requires a larger site but less complex machinery than Scheme 2. Provided that delivery of the large number of fans and the refrigerating machine for the cold store can be obtained, construction of the factory before the coming winter appears feasible. There will, however, be considerably more labour needed for handling the Pykrete at the cold store. The area of the site which has to be levelled is not more than 1/40th of one of our large aerodromes.

Scheme 3 cannot be operated at Corner Brook because the climate is too warm. Its draw-back is the lack of facilities at Seven Islands Bay. Its advantages are that it requires no machinery which has to be erected on the site by skilled labour.

It appears feasible next winter provided that sufficient machinery is available for levelling the site quickly and that labour, power and pulp could be brought to the site in sufficient quantities. It is naturally the cheapest scheme from the point of view of Pykrete production, since the work is done by nature. If successful, the large extension necessary to build several Habbakuks in the following winter should not present insuperable obstacles.

Improved methods of production requiring less space are under active consideration.

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III. TABLE OF COSTS IN POUNDS STERLING

SCHEME	1	2	3
Levellings, foundations, buildings, roads, tunnels	1,290,000	430,000	1,290,000
Fans or scoops	115,000	-	20,000
Refrigerating plant, buildings and stores	263,000	1,900,000	-
Power cables	15,000	15,000	500
Spreaders	25,000	8,000	25,000
Saws and cutters	30,000	10,000	30,000
TOTAL CAPITAL OUTLAY	1,758,000	2,363,000	1,365,000
Transport of raw material	-	-	1,190,000
Cost of operating power	119,000	269,000	3,000
Labour cost	105,000	45,000	40,000
Cost of raw material	1,900,000	1,900,000	1,900,000
TOTAL OPERATING COST	2,124,000	2,214,000	3,133,000
TOTAL COST	3,882,000	4,577,000	4,498,500
Cost of Pykrete per ton (Excluding capital outlay)	£1. 5. 0	£1. 3. 0	£1.17. 0
Cost of Pykrete per ton (Including capital outlay)	£2. 5. 7	£2.14. 0	£2.12. 9

HORSE POWER REQUIREMENTS IN B.H.P.

Refrigerating plant	3,840	30,000	-
Fans	22,500	-	-
Spreaders	375	160	375
Saws	200	100	200
Cranes, lifts, etc.	500	100	100
TOTAL B.H.P.	27,415	30,360	675

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ANNEX VI

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II. SHORT EXPLANATION OF PRODUCTION SCHEMES

	Site.	Method used.	Average Atmospheric Temperature.	Period of Production. (days)	Area of Plant. (acres)	Daily Output (tons)
SCHEME I.	Corner Brook	Natural cold and artificial wind for freezing, followed by artificial aftercooling.	-5°C	100	55	17,000
SCHEME 2.	Corner Brook.	Artificial cold and artificial wind for both freezing and after cooling.	-5°C	200	18	8,500
SCHEME 3.	Seven Islands Bay or similar place on St. Lawrence.	Natural cold and natural wind for both freezing and aftercooling.	-15°C for one half of the period and -10°C for the other half.	120	53	14,200

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ANNEX VI

PYKRETE PRODUCTION

I. General Introduction
II. Short Explanation of Production Schemes
III. Table of Costs and Power
IV. Conclusions.

1. GENERAL INTRODUCTION

This report deals with the plant needed to produce 1,700,000 tons of Pykrete in block form for one Habbakuk in one winter, excluding transport to the ship and building into position. The freezing is effected in a tunnel through which is driven a blast of air at a temperature of $-25^{\circ}C = -13^{\circ}F$ and a wind speed of about 17 m.p.h. This temperature is obtained either by drawing cold air from the outside or by refrigerating it artificially. If natural refrigeration is used, then at the site chosen - Corner Brook in Newfoundland - the area of the ice form necessary to produce one vessel would be 55 acres. If artificial refrigeration were used throughout, a 35,000 H.P. would be needed in an ice factory of total area of about 25 acres.

The method of manufacture depends chiefly on the climate of the site at which the project is being executed. Two sites are being considered in this report. One is Corner Brook on the west coast of Newfoundland, and the other is Seven Islands Bay on the north bank of the St. Lawrence. Winters at Corner Brook are not cold enough to allow for natural freezing without the use of artifical aids which involve the erection of considerable plant and equipment. At Seven Islands Bay the climate is more suitable; on the other hand there is little labour, power or pulp available on the spot, while both are in ample supply at Corner Brook.

The production rates of the Pykrete are based on the results obtained by Perutz and Pascoe in their small experimental plant in London. The cost of the factory, including levellings, foundations, roads, buildings and tunnels was taken as 9d per cubic foot, electric power as $\frac{1}{2}$d per unit, semi-skilled labour at £5 and skilled labour at £7 per 48-hour week. The cost of refrigerating plant is based upon an estimate made for the machinery required to maintain the Pykrete of the Habbakuk itself at the required temperature.

Three alternative schemes have been investigated.

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ANNEX V H/1668

PYKRETE - MECHANICAL PROPERTIES

Summary

Note: All the data given below refer to a Pykrete containing 14% mechanically ground Scotch Pine wood and 86% water. The testing temperature was -15°C (5°F)

Ultimate compressive strength ..... 1,100 lb/ sq. in.
(Largest test-pieces used 12" cubes)

Ultimate tensile strength parallel to layers ..... 700 lb/ sq. in.

Ultimate tensile strength normal to layers ..... 300 lb/ sq. in.
(Largest test pieces were 2" square in cross section)

Modulus of rupture in bending ..... 1,350 lb./sq. in.
(Beams 6" square enlarged at the ends)

Modulus of rupture in torsion ..... 700 lb/ sq. in.
(Rod 2" in diameter and 17" long)

Rate of creep after 8 weeks at 100 lb/sq. in. and 5°F, using cylinder of 8" diameter and 7" high ..... 0.65% per year

Shear strength of mortar joints ..... 300/400 lb/ sq. in.

Tensile strength of mortar joints ..... 250 lb/ sq. in.

Modulus of rupture of two brick beams, 12" square, 12' long, made of 600 bricks, 6" x 3" x 2" laid in double flemish bond ..... 380 lb/ sq. in.

Young's modulus (Beam 6" square & 8' long) ..... 780,000 lb/ sq. in.

Modulus of rigidity (By torsion test on rod 2" diameter 17" long) ..... 250,000 lb/ sq. in.

Penetration of projectiles and damage by explosives can be assessed by taking it to be 2.5 times greater than that sustained by concrete having a compressive strength of 2,500 lb./sq. in.

Probable size of crater after torpedo hit - 3' deep and 15' across.
(From experiment on section of hull on 1/75th full scale)

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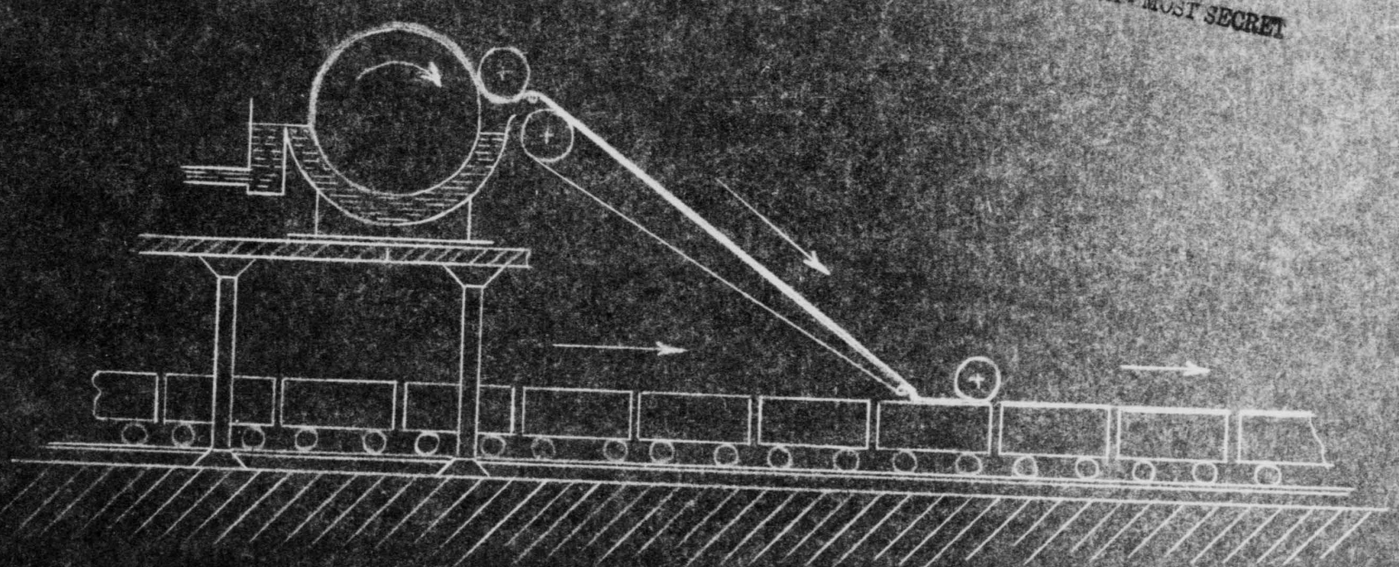

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As previously mentioned, it seems inevitable that some pulp now used for paper production is likely to be diverted and will in turn probably shut down certain machines. Consideration has been given to the possibility of adapting these existing paper machines for the purpose in question, but after due consideration the conclusion has been reached that any alterations or modifications which could readily be carried out would involve as much modification and expense as would perhaps purchase a complete filter unit. The only portion that might be used is the wire part of "wet end" as it is called. All the press part would require dismantling to receive any form of conveyor part necessary, and even if this were done the layout and construction of the remainder of the machine, which is very massive, would considerably restrict further adaption and probably necessitate transporting any sheet obtained long distances to a refrigeration unit which it is felt could not readily be installed in any modern machine room to deal with the productions proposed. The sheet obtained in such a case would, however, be very thin - something of the order 1/16" to 1/32" - and would be upwards of 200 inches in width; such a sheet would require considerable care in handling if even it were possible to transfer it from the machine wire to the conveyor and the production obtained, it is felt, would not finally justify the undertaking.

Simple paper machines, or "wet machines" as they are known in the trade, are often used for thickening pulp suspensions and might be considered since they are comparatively simple in construction. The same arguments which condemned the adaption of paper machines applies more forcibly here while, in addition, the production would be proportionately lower and thus entail the employment of many extra units which in turn would require larger buildings and additional labour for their operation.

The adoption of a rotary filter unit would finally mean that the sheets would be formed and delivered at the refrigeration unit by means of a compact machine capable of very high rates of production as the pulp suspension is easily pumped over reasonable distances and not entail fitting in the refrigerating unit at some convenient sheet forming position where the final handling of large bulky heavy products would become impossible in the limitations of existing buildings already full of auxiliary plant necessary for operating a paper machine proper, around which it would not be easy to superimpose further heavy machinery of the type required.

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Manufacturers of such plants in Canada and in the U.S.A. are fairly numerous and their experience with them and application to special purposes is much more extensive than in this country. A list of the most prominent of these manufacturers is as follows:-

Whiting Corporation (Canada) Ltd., Toronto.
American Paper Machinery & Eng. Works Inc., Montreal
Canadian Ingersoll Rand Co. Ltd., Montreal
Northern Foundry and Machine Coy., Ltd., Sault Ste. Marie, Ont.
Port Arthur Shipbuilding Coy., Port Arthur.
Sherbrooke Machineries Ltd., Sherbrooke, Que.

additional information and reference can be obtained from the headquarters of the Canadian Pulp and Paper Association (Technical Section) 3420 University St., Montreal.

A rough sketch has been prepared and is attached to show how the whole scheme may be envisaged. The fitter would be located in a suitable position close to the refrigeration unit and elevated above ground level. Pulp in slurry form containing about 2-3 % of fibre where it would be fed to the vat of the filter. The filter drum rotating in this would carry out with it the pulp mat or sheet which would be subject to further de-watering under control until it reached the couching roll which would then detach it from the cylinder and from which in turn it would be transferred to the conveyor belt. This conveyor would slope downwards and be capable of being raised and lowered at the lower end. The pulp sheet at the required consistency of 10-14% fibre would then be discharged in a continuous sheet on to a line of trucks with platforms touching and moving forward at the same speed as the sheet is discharged. If the trucks with the sheets are then subject to natural refrigeration in the open or artificial treatment inside, they in turn can be returned to a line when frozen and receive a further layer. A roller adjustable for height, preferably slightly corrugated is suggested for compounding the second

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and succeeding layers, and if due precautions are taken against excessive pressure no moisture should be lost; any that may exude will be immediately reabsorbed uniformly and should give rise to no difficulties about uniformity unless it is allowed to over-run at the edges. It will be noted that no provision for cutting has been made. In dealing with a sheet so weak it is not considered necessary and the inevitable relative movement between trucks will be sufficient to cause a break in the sheet between trucks as they move forward, as only single layers are at any period in question and it is presumed an exact and absolutely smooth sided geometrical shape is not required at this stage.

The refrigeration part has not been considered in detail as it is understood that this is having the attention of refrigeration experts. Collaboration between the makers of both parts, however, will become ultimately necessary when closer consideration is being given to the details of how the sheets delivered from the filter conveyors are to be finally dealt with and handled in the refrigeration unit.

The grade of groundwood pulp which so far has been used in the experiments may be described as being rather short and fine which in pulp technical language has a Canadian freeness around 90 ccs. It is possible that grades which are slightly longer and somewhat coarser may be used with advantage without causing any decrease in the physical properties of the resulting material. Such grades could easily be produced from spruce as distinct from the fine grades obtained here and home grown pinewood. In such a circumstance, then, production rates per square foot of filter area may be increased. Known performances on such machines de-watering to lower moisture contents than at present being considered handle aroun 0.2 tons of dry pulp per square foot per day. More up-to-date data on performance, however, can readily be obtained from the engineering side of the paper industry in Canada and the U.S.A. as well as from the makers of the various filters.

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EDWARD LLOYD LTD.,
KEMSLEY,
NR. SITTINGBOURNE.

9th September, 1943

THE FORMATION OF LOW CONSISTENCY PULP SLABS FROM GROUNDWOOD PULP SUSPENSIONS.

The problem of producting pulp slabs of low consistency continuously and in large quantities has been given considerable attention since discussions first took place on this matter. The consistency or composition now required - 10/14% of fibre - is intermediate between those normally used in the pulp and paper industry. In the slush form pulp is handled by pumping at consistencies varying from 1-6%, and in the sheet form from 20% upwards, the interval between giving rise to the various degrees between slush and sheet which in turn impose limitations in the transport and handling of each as the stage from the one form to the other is reached.

At 10/14% it is possible, however, to produce a sheet, but as such it has little or no physical strength and requires support on conveyors or belts if transportation is to be undertaken. The present problem as presented also requires considerable tonnages over a comparatively short period of time and any scheme, therefore, will of necessity require a high rate of production and should be continuous. It is from this angle that the suggestions to be made are prompted.

The question of simplicity of design and manufacture of the equipment to produce the sheets from which the slabs will finally be made has been borne in mind and whereas simpler machines can be made, their production rate is very low accordingly and in consequence would entail duplication in numbers as well as extra floor space, buildings, extra labour

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[illegible] and overall high costs. For these reasons, therefore, the use of rotary filters suitably modified are suggested as they appear to have all the necessary requirements. In principle these consist of a large cylinder mounted horizontally and divided into segments and covered on the circumference with a suitable filtering material such as wire gauze. Each segment in turn is connected to a central channel passing through one of the supporting spindles. The cylinder in turn sits in a vat which is filled up to about the cylinder spindle with the material to be filtered. Means are provided to keep this at a constant level while the cylinder rotates at a pre-determined speed. Suction is applied to the segments through the central channel in the spindle and in this way a mat of pulp is formed on the circumference of the cylinder as it rotates through the vat. On emerging it is subject to vacuum and de-watering until the pulp mat reaches the pre-determined spot at which it is continuously removed in sheet form. The composition of the pulp mat obtained in terms of fibre content in this case is governed by the rate at which the cylinder is moving, the composition of the pulp slush in the vat, vacuum applied and nature of the pulp being de-watered.

In pulp and paper mill practice such machines are now extremely used for thickening, washing and bleaching purposes for which of necessity they require to have many additional refinements and fixtures, but for the present purpose these are not required so that the equipment resolves itself essentially into a cylinder and vat, a conveyor to carry the pulp mat to the refrigeration stage and the necessary pulp slush and vacuum pumps.

As the production rates are to be high, mills operating the scheme presumably would have a considerable part of their pulp production diverted to this end and would most likely require to curtail paper production accordingly. It is possible therefore by selecting certain mills already in possession of such plants, provided they fulfilled other requirements such as suitable location, that these could be ready adapted for the purpose and put into use while new plant, if required, was being built.

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VISIT TO R.R.L. - 6th May, 1943.

A section of the hull of Habbakuk on 1/75th of the full scale was constructed by the sealing together of blocks 2 feet square and 8 inches thick. The dimensions are shown in the accompanying drawing. A sheet of fibre board 1/8" thick was sealed on to the "outside surface" and another board was used to seal off the interior of the section against penetration of water.

The model was lowered into a tank and submerged in water up to a distance of 10" from the "deck", of 3/4 of the total height.

A charge consisting of 4 submarine electric detonators, each containing 2 grammes mercury fulminate, was detonated in contact with the "hull" at the centre of the section. The water in the tank was then drained off in order to ascertain the damage. There was a hole in the fibre board 1¼" x 3/4" diameter and a crater in the Pykrete underneath 2½" across and 1/2" deep. Repercussion of the explosion blew a hole in the fibre board sealing off the air space at the back. It also cracked the seal between the fibre board and the Pykrete in front; this had probably been weakened badly by melting before the explosion took place.

In view of the damage done by four dets, we decided to use 16 on the same model. Before submerging it again, we stripped off the fibre board and put the dets in contact with

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the Pykrete. This time damage was very extensive. There was a crater 3" across and 1¼" deep. In addition the blast blew the central block in the "hull" right off the "bulkheads" and cracked all the seals between the component blocks of the model. Moreover, the central block was cracked in two of the laminer planes and had two vertical cracks normal to them.

CONCLUSIONS: On one 75th of the full scale one detonator is equivalent to a torpedo containing 850 grammes of torpex. In view of the very great difference in scale involved we deemed it advisable to apply a safety factor of four and use four detonators instead of one. Thus the first charge may be taken to correspond to a torpedo in contact with the wall of the vessel. Scaled up to full size the crater in the Pykrete would be 3 ft. 2 ins. deep and 16 ft. across. The hole in the insulating board would be 5 ft. to 8 ft. across.

The second charge would correspond to 16 torpedoes on full size.

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Test 5	.303 armour piercing bullet produced the same crater as (3). Total penetration 165 mms.
Comparison. Concrete	Same concrete as above penetration 71 mms. Ratio concrete to ice 1 : 2.3
Test 6.	Boys Anti-tank rifle. .55" armour piercing bullet Mark 2 Speed 2800 ft/sec. Bullet went right through the block. In front it produced a crater 43 mms. deep and 80 mms. across. It cracked the block into two slabs along a laminar plane and produced large damage on the other side, i.e., a crater 25 cms. across; bits of laminar broke out over a large area. - It has to be kept in mind that this specimen had been subjected to tests (3), (4) and (5) and was already damaged before the test.
Test 7.	Same rifle. This time two blocks were placed one behind the other. Crater 33 mms. deep and 115 mms. diameter. 1 circular crack 15 cms. diameter, 2 shallow radial cracks 23 cms. long. Slight bulge at the crack of first block. Second block was thrown over backwards and damaged by the fall. Projectile was eventually found in second block. Total penetration 19" or 48 cms.
Comparison Concrete	Penetration 7" or 18 cms. Ratio concrete to ice 1: 2.7.
Test 8.	No. 8 submarine electric detonator produces crater 14 mms. deep, 69 mms. in diameter. No cracking

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Comparison Pure Ice	Crater is 100 mms. in diameter and 38 mms. deep. Cracking right through the slab of same size as ours.
Test 9.	20 mms. Hispano H.E. incendiary shell completely shattered blocks into large fragments. No melting is visible.

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VISIT TO R.R.L.

18th March, 1943 H/576

Experimental Conditions.	Tests performed on blocks of pulped ice 2-ft. square and 11" thick. The blocks were taken out of the cold store at 8.30 a.m. and had a temperature of -18°C. The tests were started at 10 a.m. and concluded at 12 noon. Hence the initial temperature was probably -10° to -5°C. to 0°C.
Test 1.	3/32" steel ball (pellet) travelling at 2000 ft/sec. produced a crater 6 mmms. deep and 7 mms. across. No other damage. Pellet could not be found and left no track.
Comparisons. (a) Pure Ice	The same pellet travelling at 2267 ft./sec. at -6°C. results in damage to a depth of 69 mms. Crater diameter 33 mms. and large radial cracks of 86 mms. diameter on the average. Depth of crater 9 mms. is uncertain because of ice powder in crater.
(b) Pine Wood.	3/32" pellet at 2000 ft/sec. penetrates between 12 and 24 mms. depending on whether shot is parallel or normal to grain.
(c) Sand.	Same conditions 27 mms. penetration.
(d) Telephone Directory.	" " 13 " "
(e) Cellulose	" " 4 " "

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acetate

(f) Duralumin " " 1.5 " "

(g) Aluminium " " 2.3 " "

Test 2. ¼" steel ball travelling at about 2000 ft./sec produced a crater 16 mms. deep and 28 mms. in diameter. No cracking of any kind beyond crater. Total penetration of 48 mms.

Comparison Pure Ice. Same pellet travelling at 2800 ft./sec produced a crater of 83 mms. diameter and indefinite depth; also severe radial cracking throughout specimen of the same size as our own at a temperature of 0 to -1°C.

Test 3. .303 rifle bullet (soft lead) travelling at 2440 ft/sec. Maximum crater diameter 60 mms. depth 25 mms., bullet disintegrates and cannot be traced. Furthermore there are two circular cracks of maximum diameter 75 and 145 mms. and five radial shallow cracks extending to a distance of 10 cms. from the point of impact.

Comparison Concrete Concrete (3/4 stone) crushing strength 2500 lbs./sq.in. Penetration is 2½" or 63 mms.

Test 4 Same conditions as in (3) but projectile fired parallel to plane of the layers. Produced a slightly smaller crater without any circular cracking, but cracked most of the block along one or two laminar planes. Not sufficient though to split the block or even to render it possible to split the block easily with hammer and chisel afterwards

Test 5

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acetate

(f) Duralumin " " 1.5 " "

(g) Aluminium " " 2.3 " "

Test 2. ½" steel ball travelling at about 2000 ft./sec produced a crater 16 mms. deep and 28 mms. in diameter. No cracking of any kind beyond crater. Total penetration of 46 mms.

Comparison Pure Ice Same pellet travelling at 2800 ft./sec produced a crater of 83 mms. diameter and indefinite depth; also severe radial cracking throughout specimen of the same size as our own at a temperature of 0 to -1°C.

Test 3. .303 rifle bullet (soft lead) travelling at 2440 ft/sec. Maximum crater diameter 60 mms. depth 25 mms., bullet disintegrates and cannot be traced. Furthermore there are two circular cracks of maximum diameter 75 and 145 mms. and five radial shallow cracks extending to a distance of 10 cms. from the point of impact.

Comparison Concrete Concrete (3/4 stone) crushing strength 2500 lbs./sq.in. Penetration is 2½" or 63 mms.

Test 4 Same conditions as in (3) but projectile fired parallel to plane of the layers. Produced a slightly smaller crater without any circular cracking, but cracked most of the block along one or two laminar planes. Not sufficient though to split the block or even to render it possible to split the block easily with hammer and chisel afterwards

Test 5

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Table X.

Results of Shear Tests on Jointed 14% Pykrete.

Dimensions of test piece in.	Section under shear stress: in.	Type of joint	Temperature of test °C.	Testing speed: in./min.	Shear strength: lb./sq.in.	Average shear strength lb./sq.in.
8 x 2 x 1 (Fig.7)	2 x 1 (double)	6% Pykrete formed hot (70°C.)	-15	0.03	510 450 970	640
do.	do.	do.	"	1.0	560 740 1100	800
do.	do.	6% Pykrete formed cold (5°C.)	"	0.03	710 650 720	690
do.	do.	do.	"	1.0	490 770 1110	790

Remarks on Fractures.

In general, initial distortion of the specimen occurred in the joint material, followed by actual separation at an ice layer between mortar and 14% pykrete. In one or two cases, complete separation of the specimen into three pieces occurred.

3. Bend Tests on large beams.

Two specimens of each of two types were used for transverse bending tests on jointed beams; each was roughly 12 ft. x 1 ft. x 1 ft. in dimensions. In the first type, each specimen consisted of twelve 1 ft. cubes of 14% pykrete, one having joints about ½ in. thick made with cold (5°C.) 6% pykrete and the other having joints made with hot (70°C.) pykrete. The second type consisted of a beam constructed of small blocks of 14% pykrete each about 6 in. x 3 in. x 2 in. in dimensions, laid in the pattern of double Flemish bond; the horizontal joints were made with a mortar of cold 14% pykrete, and the vertical joints with 6% pykrete applied hot (70°C.); all of the joints were roughly ⅜ in. thick. In all four cases the layers were horizontal.

Four point loading technique was adopted in each test, load being applied by two hydraulic jacks and measured by means of "Statimeters" placed between the tops of the jacks and the underside of the beam. A photograph of the arrangement used for the tests on the beams composed of small blocks is shown in Fig.30; the photograph Fig.31 shows the fracture of the first beam of this type. The tests were carried out in a cold room maintained at a temperature of -15°C.

Deflections of each beam on a central span of 36 in. were measured at increments of load, and the observations in one test of each type are shown plotted in Fig.25.

The results of the tests are given in Table XI.

Table/

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for tension tests on 14% pykrete, described in Section I. Each specimen was held in shaped grips and tested in a 3 ton hydraulic testing machine. During the test the specimen was enclosed in an insulated hollow container filled with paraffin oil and cooled with solid carbon dioxide. The temperature was indicated by a thermocouple attached to the surface of the specimen. Tests were made on both 'hot' and 'cold' jointed specimens at a temperature of -15°C. at testing speeds of 0.02 and 1.0 in. per minute.

The results of the tests are given in Table IX.

Table IX.

Results of Tension Tests on Jointed 14% Pykrete.

Type of test piece	Type of joint	Temperature of test °C.	Testing speed: in./min.	Tensile strength: lb./sq.in.	Average tensile strength: lb./sq.in.
Fig.2. Section 2 in.x 2 in. Three joints	6% Pykrete formed hot (70°C.)	-15	0.02	740) 440) 690)	620
do.	do.	-15	1.0	210) 110) 340)	220
do.	6% Pykrete formed cold (5°C)	-15	0.02	450) 400) 460)	440
do.	do.	-15	1.0	460) 50*) 430)	440

* This result is not included in the average; the fractured surface of this specimen was irregular.

Remarks on Fractures.

In each case fracture occurred at a joint, through an ice layer between the mortar and the 14% pykrete.

2. Shear Tests.

Shear tests on joints were made on specimens prepared from blocks of 14% pykrete, the dimensions of which were 8 in. x 2 in. x 1 in. The centre 4 in. length was cut from each block and rejoined, in a suitable jig, by a mortar of 6% pykrete. As for the tension tests, the joints were about 0.2 in. thick and of two types, 'hot' and 'cold', and their preparation was carried out under conditions similar to those already described. In all cases, the layers of the 14% pykrete were perpendicular to the direction of application of the shearing load. (A diagrammatic representation of the test is given in Fig.7 in which it can be seen that both joints of a specimen are subjected to shear stress). Tests were made at a temperature of -15°C. and at testing speeds of 0.02 and 1.0 in. per minute. In each test, the apparatus was enclosed in a suitable insulated hollow container filled with paraffin oil cooled with solid carbon dioxide, and the temperature was indicated by a thermocouple attached to the surface of the specimen.

The results of the tests are given in Table X.

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Table VIII

Results of Creep Compression Tests on 14% Pykrete.

Dimensions of test piece	Temperature of test: °C.	Nominal stress applied: lb./sq.in.	Creep rate in 10-6 in./in./hour after 100 hours	200 hours	300 hours	500 hours	700 hours
1 in. cube	- 3	25	3	4	1	-	-
		50	8	5	1	-	-
		100	11	9	8	-	-
		150	86	60	-	-	-
		200	110	-	-	-	-
1 in. cube	-10	50	11	7	5	5	3
		100	8	6	3	3	2
		300	30	10	19	19	72
		400	48	5	57	-	-
1 in. cube	-15	50	1	1	1	1	1
		100	4	3	2	2	2
		300	18	16	15	12	4
		400	19	16	1	13	7
		550	19	16	21	15	15
1 in. cube	-20	100	3	3	3	3	3
		200	8	4	4	3	3
		300	8	4	4	3	2
		400	10	6	5	4	3
		500	20	17	15	12	-
8 in. dia.x 7 in. high	-10	50	2.0	1.3	0.9	0.4	0.3
		100	7.3	4.4	3.6	2.0	2.4
8 in. dia.x 7 in. high	-15	50	2.0	1.3	0.7	0.4	0.1
		100	6.2	3.7	2.7	1.1	0.9

Remarks.

No explanation has been found for the anomalous results of the test at 50 lb./sq.in. at -10°C.

SECTION II. Tests on Jointed 14% Pykrete.

1. Tension Tests.

The specimens used for tension tests on the jointed material were prepared from test pieces of the form shown in Fig.2. Three saw-cuts were made transversely through each test piece at positions 2 in. apart along the central parallel portion. The sections were then re-joined by means of a mortar of 6% pykrete in a suitable jig. The joints were of two types, 'hot' and 'cold', depending on the temperature of the mortar at the time the joint was made. The 'hot' joints were made with the mortar at a temperature of about 70°C., and the 'cold' joints with the mortar at about 5°C. The specimens were prepared in a cold room at a controlled temperature of -15°C. In all cases the layers of the 14% pykrete were parallel to the face of the specimen. The three joints in each specimen were of the same type, and were about 0.2 in. in thickness. Thin ice layers formed between the mortar and the joined sections.

The tests were carried out by the method employed for/

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In all tests the load was applied perpendicular to the layers.

For the tests on 1 in. cubes, four machines were constructed each to test five specimens simultaneously and each consisting of five simple levers; a photograph of one machine is shown in Fig.28. The machines were set up in four separate cold rooms at controlled temperatures of -3°, -10°, -15° and -20°C. respectively, the compressive stresses ranging from 25 to 550 lb./sq.in. The load on each specimen was maintained constant for a period of about four weeks. The compression of each specimen was indicated by a dial gauge (see Fig.29) and was recorded at regular intervals.

Prior to the commencement of the tests, each specimen was coated with vaseline in order to reduce evaporation from the surface.

The compression-time curves are shown plotted in Figs. 19 to 22.

In the tests on the larger specimens, (8 in. dia. x 7 in. high) load was applied by means of a calibrated compression spring; in each of the four machines constructed for this purpose, the compression of the spring under load was about 12 in., and the reduction in stress of the specimen during creep, due to lengthening of the spring, was less than 1% and was ignored.

Tests were carried out at stresses of 50 and 100 lb./sq.in. in cold rooms at controlled temperatures of -10°C. and -15°C. The creep of each specimen was measured by two dial gauges at opposite ends of a diameter, and was recorded at regular intervals.

The observations are shown plotted in the compression creep-time curves given in Figs.23 and 24.

The creep rates at various times deduced from all of the above tests are given in Table VIII.

Table/

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The results of the bend tests are given in the two following Tables, the values of modulus of elasticity in Table VI and the values of modulus of rupture in Table VII.

Table VI.

Results of Bend Tests on 14% Pykrete.
Values of Modulus of Elasticity

Temperature of test °C.	Dimensions of test piece	No. of Test	Direction of load with respect to layers	Modulus of Elasticity E lb./sq.in.	Range of stress used for determination of E: lb./sq.in.
-15	8'x6"x6"	1	Parallel	0.73×10^6	(Tangent at origin)
-15	do.	2, 1st loading	Perpendicular	0.76×10^6	do.
		2nd "		0.74×10^6	0 - 140
		3rd "		0.75×10^6	0 - 160
		4th "		0.83×10^6	0 - 200
		5th "		0.83×10^6	0 - 200
-15	do.	3, 1st "	do.	0.76×10^6	0 - 100
		2nd "		0.76×10^6	0 - 250
-15	do.	4, 1st "	Parallel	0.78×10^6	0 - 200
		2nd "		0.78×10^6	0 - 200
		3rd "		0.81×10^6	0 - 200
		4th "		0.78×10^6	0 - 200

Average Value: 0.78×10^6 lb./sq.in.

Table VII.

Results of Bend Tests on 14% Pykrete.
Values of Modulus of Rupture

Temperature of test °C.	Dimensions of test piece	No.of Test	Direction of load with respect to layers	Modulus of Rupture lb./sq.in.	Average value lb./sq.in.
-15	12"x1½"x1" (Fig.5)	1	(no layers)	1500	1680
		2	"	1600	
		3	"	1600	
		4	"	2000	
-15	8'x 6" x6"	5	Parallel	1350	1370
-15	8' x 6"x 6" (Fig.6)	6	Perpendicular	1330	
		7	"	1420	
		8	"	1390	

Remarks on Fractures.

Test piece No.5 was of uniform section, and fractured simultaneously at both inner loading points.

Test piece No.6, after fracture, showed considerable separation of layers, probably due to poor bonding during manufacture.

6. Creep Tests in Compression.

Tests were carried out on specimens in the form of (a) 1 in. cubes and (b) cylinders 8 in. diameter, 7 in. high.

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Table V.

Results of Torsion Tests on 14% Pykrete.

Temperature of test: °C.	Direction of layers with respect to axis of test piece	Modulus of Rupture: lb./sq.in.	Modulus of Rigidity: lb./sq.in.	Stress range used for determination of Modulus of Rigidity	Total angle of twist at fracture
-15	Parallel	680	0.23×10^6	(Tangent at stress of 25 lb./sq.in.)	45°
		720	0.27×10^6	(Tangent at origin for first loading)	40°
			0.27×10^6	0-28 lb./sq.in. for second loading	

Remarks on Fractures.

Each specimen fractured near the centre of the parallel portion, partly across and partly along the layers, the fracture extending over about 4 in. No longitudinal cracks were observed.

5. Bend Tests.

Transverse bending tests were carried out on small shaped beams of the type shown in Fig.5 and on larger shaped beams as shown in Fig.6. Additional tests to determine the modulus of elasticity of the material were made on rectangular beams 8 ft. x 6 in. x 6 in.

Tests on the small beams were made in a cold room at a controlled temperature of -15°C. Each specimen was supported symmetrically on steel rollers 12 in. apart and loaded at two points 6 in. apart, the central portion thus being subjected to a constant bending moment. The load was applied through a lever mechanism by dead weights till fracture occurred. The specimens in these particular tests were prepared in special moulds and had no layers.

Tests on the larger beams were also carried out using four-point loading in a cold room at a controlled temperature of -15°C. In the tests on the rectangular beams to determine the modulus of elasticity in bending, load was applied to the beam in small increments through simple lever systems. The corresponding deflection readings of the centre portion of the beam were obtained by means of a deflectometer on a 36 in. span. The recorded observations were plotted and the value of the modulus of elasticity computed from the curve. Typical load-deflection curves are shown in Figs.16, 17 and 18. Tests were carried out with the layers horizontal and vertical respectively, the layers in both cases being parallel to the length of the beam. In one test the load was further increased till fracture occurred, the method adopted being that employed in tests on the large shaped beams as described below.

Tests on the large shaped beams were carried out to determine the modulus of rupture. The load in each case was applied by means of two hydraulic jacks and was measured by calibrated "Statimeters" inserted between the jacks and the beam. The arrangement used was very similar to that shown in the photograph (Fig.30) of a brick beam under test (described later).

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respectively, the layers in the latter case being horizontal. Three specimens were tested under each set of conditions and the results are given in Table IV.

In the case of tests at 0.02 in. per minute, load-time readings were recorded and curves drawn. Typical examples of such curves are shown in Fig.13.

Table IV

Results of Shear Tests on 14% Pykrete.

Temperature of test: °C.	Testing speed: in./min.	Direction of load with respect to layers	Shear strength: lb./sq.in. Individual Results	Average
-15	0.02	Parallel	500, 480, 770	580
		Perpendicular	1190, 1060, 1010	1090
	1.0	Parallel	150, 730, 440	440
		Perpendicular	1090, 970, 1140	1070

Remarks.

In the "parallel" tests, failure always occurred at the ice layers nearest to the two planes of shear. The scatter of the results is probably due to variations in the distances between the planes of shear and the nearest ice layers.

4. Torsion Tests.

Torsion tests were carried out on specimens of the type shown in Fig.4 machined from blocks. A photograph showing a specimen in position in the torsion apparatus is given in Fig.28. The upper end of the specimen to be tested was clamped in a vertical position in a rigid wooden framework. To the lower end a wooden torque arm was fastened centrally. Two wires were attached at opposite ends of the torque arm, passing horizontally over pulleys and supporting light scale pans. A torsional load could thus be applied to the test piece by the addition of equal weights to each scale pan.

Measurements of the angle of twist on a 15 in. gauge length were made using a mirror type twist-meter, the mirrors being mounted on special wooden clamps attached to the parallel portion of the specimen. Corresponding readings were taken for equal increments of load and the calculated values of shear stress and strain are shown plotted in Figs.14 and 15. It will be seen that a complete stress-strain loop was determined for the material, the torque being increased to a maximum alternately clockwise and anti-clockwise.

Two torsion tests were carried out in a temperature controlled atmosphere at -15°C., the layers of the specimen being parallel to the axis in each case. The tests were continued until failure of the specimens occurred, the angle of twist at fracture being recorded. The modulus of rupture and the modulus of rigidity were determined and the results are given in Table V.

Table/

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cold container was used for these tests; thermocouple measurements of the temperature of the inside of each specimen made immediately after test showed that the specimen during test was generally at -15°C.

The results of the compression tests are given in Table III.

Table III

Results of Compression Tests on 14% Pykrete.

Type of test piece	Temperature of test: °C.	Testing speed: in./min.	Direction of load with respect to layers	Compressive strength: lb./sq.in.	
				Individual results	Average
3 in. cube	-10	0.02	Parallel	800, 670, 580	680
			Perpendicular	880, 800, 850	850
		0.1	Parallel	1120, 1130, 1080	1110
			Perpendicular	1110, 1120, 1020	1080
		1.0	Parallel	1550, 1360, 1230	1380
			Perpendicular	1580, 1560, 1430	1560
3 in. cube	-15	0.02	Parallel	1030, 1010, 950	1000
			Perpendicular	1060, 1030, 1100	1060
		0.1	Parallel	1140, 1410, 1450	1330
			Perpendicular	1380, 1380, 1370	1360
		1.0	Parallel	1470, 2290, 2280	2010
			Perpendicular	2230, 1950, 2010	2060
12 in. cube	-10	0.1	Perpendicular	810* 940*	880

* Creep of each specimen appeared to take place at very low stresses (about 30 lb./sq.in.).

Note.

The compressive strength of the material in each test at speeds of 0.02 and 0.1 in. per minute was computed from the value of the load at which the load-time curve showed a marked decrease in slope. In the tests at 1.0 in. per minute this point was indicated by a definite arrest of the testing machine pointer.

Remarks on Fractures.

Each test was continued until a total compression of about 1 in. was obtained. In the case of specimens loaded parallel to the layers, splitting occurred along one or more of the ice layers. Specimens tested perpendicular to the layers showed in general considerable bulging at the sides with numerous small cracks parallel to the loading direction.

3. Shear tests.

Shear tests on unjointed 14% pykrete were made on specimens 6 in. x 2 in. x 1 in. in dimensions. The tests were carried out under double shear conditions in the apparatus shown in Fig.3, the load being applied by a 3 ton hydraulic testing machine. During each test the apparatus was enclosed in an insulated hollow container filled with paraffin oil and cooled with solid carbon dioxide. The temperature was indicated by a thermocouple attached to the surface of the specimen. Tests were made at a temperature of -15°C. and at testing speeds of 0.02 and 1.0 in. per minute with the layers parallel and perpendicular to the stressed sections respectively/

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Table II

Results of Tension Tests on 14% Pykrete.

Type of test piece	Temperature of test: °C.	Testing speed: in./min.	Direction of load with respect to layers	Tensile strength - lb./sq.in.	
				Individual results	Average
Fig.1 (section 1 in. x 1 in.)	-10	0.02	Parallel	830, 790, 760, 770, 820	790
			Perpendicular	700, 330, 570, 470, 510	520
		0.1	Parallel	680, 800, 860, 690, 720	750
			" *	710, 720, 730, 670, 820	730
			Perpendicular	270, 400, 250, 300, 270	300
		1.0	Parallel	830, 710, 700, 820, 780	770
			Perpendicular	180, 210, 290, 260, 160	210
Fig.1 (section 1 in. x 1 in.)	-15	0.02	Parallel	910, 860, 940, 1050, 1050	960
			Perpendicular	470, 570, 500, 460, 440	490
		0.1	Parallel	800, 810, 920, 990, 780	860
			Perpendicular	370, 320, 270, 290, 210	330
		1.0	Parallel	630, 680, 750, 810, 920	760
			Perpendicular	330, 340, 180, 170, 150	230
Fig.2 (section 2 in. x 2 in.)	-15	0.02	Parallel	720, 840, 780	780
			Perpendicular	190, 160, 190	180
		1.0	Parallel	490, 770, 570	610
			Perpendicular	160, 190, 60	140

* The layers in this case were parallel to the thickness of the test pieces. In all other parallel cases the layers were parallel to the width.

Remarks on Fractures.

The fractured surfaces of specimens tested with the layers parallel to the loading direction presented a rough appearance. Fracture of the specimens tested with the layers perpendicular to the loading direction invariably occurred at an ice layer and the fractured surfaces were smooth.

2. Compression Tests.

The majority of compression tests were carried out on specimens in the form of 3-inch cubes. These were placed between flat sheets of insulating material and loaded through a spherical seating in a 15 ton hydraulic testing machine. Throughout the tests each specimen was enclosed in an insulated hollow container filled with paraffin oil and cooled with solid carbon dioxide. The temperature was indicated by a thermocouple attached to the surface of the specimen. Tests were made at temperatures of -10°C. and -15°C., at testing speeds of 0.02, 0.1 and 1.0 in. per minute, with the layers parallel and normal to the direction of loading respectively. Three specimens were tested under each set of conditions.

In the case of tests at speeds of 0.02 and 0.1 in. per minute, load-time readings were recorded and curves drawn. Typical examples of such curves are shown in Figs.11 and 12.

Two compression tests on a larger scale were carried out on specimens in the form of 12 inch cubes. Immediately after removal from a refrigerator maintained at -15°C. these were placed between flat sheets of insulating material and loaded through a spherical seating in a 500 ton hydraulic testing machine. No

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Table I

Particulars of Mechanical Tests.

Material	Type of test	Dimensions of effective test section: in.	Remarks
14% Pykrete	Tension	1 x 1	
	"	2 x 2	
	Compression	3 x 3	
	"	12 x 12	
	Shear	2 x 1	Double shear method.
	Torsion	2 (diameter)	Moduli of Rupture and Rigidity determined.
	Bend	1½ x 1	Specimens not laminated. Modulus of Rupture determined.
	"	6 x 6	Moduli of Rupture and Elasticity determined.
	Creep in compression	1 x 1	
	Creep in compression	8 (diameter)	
Jointed 14% Pykrete	Tension	2 x 2	
	Shear	2 x 1	Double shear method.
	Bend	12 x 12	Blocks 12 in. cube.
	"	12 x 12	Blocks 6 in. x 3 in. x 2 in.
	Bond strength	-	Timber 1 in. square embedded in jointed blocks 5 in. x 5 in. x 1½ in.
	Creep in shear	2 x 1	Double shear method.

Tests were made under certain combinations of the following conditions:- temperatures of -15°, -10° and -3°C., testing speeds of 0.02, 0.1 and 1.0 in. per min., the pykrete layers either parallel or normal to the axis of the specimen.

SECTION I. Tests on 14% Pykrete.

1. Tension Tests.

The specimens used for tension tests are shown in Figs.1 and 2. Each type was held in shaped grips, and the tests were carried out in a 3 ton hydraulic testing machine. During test, each specimen was enclosed in an insulated hollow container filled with paraffin oil cooled with solid carbon dioxide. The temperature of the specimen was indicated by a thermocouple attached to it.

Tests on the small specimens were carried out at temperatures of -10°C. and -15°C., at testing speeds of 0.02, 0.1 and 1.0 in. per minute, with layers parallel and normal to the direction of load respectively. At least three specimens were tested under each combination of the above conditions.

Tests on the larger specimens were carried out at a temperature of -15°C., at testing speeds of 0.02 and 1.0 in. per min., with layers parallel and normal respectively to the direction of load.

For the majority of tests at speeds of 0.02 and 0.1 in. per minute on both types of specimen, load-time readings were recorded and curves drawn. Typical examples of such curves are shown in Fig.10. The results of the tests are given in Table II.

Table/

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Engineering Department

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Some Mechanical Properties of Pykrete at Temperatures below 0°C.

by

C.E.Phillips, Wh.Sc., A.C.G.I., D.I.C.
and
R.C.A.Thurston, B.Sc., A.Inst.P.

(Work performed for D.S.R., Admiralty).
Report submitted by Dr.S.L.Smith,
Superintendent, Engineering Department,
National Physical Laboratory.

September, 1943.

Introduction.

The material which is herein referred to as "Pykrete" and the properties of which have been determined, is composed of a frozen mechanical mixture of wood pulp and water; the wood used was Scotch pine. Throughout this investigation the manufacture of the material was carried out by Dr.M.F.Perutz and K.J.Pascoe of Combined Operations Headquarters in a temperature controlled atmosphere; the conditions of manufacture were:

(a) Composition of 14% pulp, 86% water giving a density of 0.988 gm./c.c.
(b) Rate of growth when spread in $\frac{3}{8}$ in. thick layers, of about 0.02 inches in thickness per minute at -15°C. with a wind velocity of 20 ft./sec.

All the material thus prepared and subsequently tested was in the form of layers roughly $\frac{3}{8}$ in. thick spread by hand. Owing to the nature of the substance, each layer was separated from the next by an ice layer less than $\frac{1}{2}$ mm. thick. In general, small specimens were cut from large blocks, one or two feet cube. All the specimens were designed by the authors and the majority were prepared by Dr.M.F.Perutz and K.J.Pascoe, who also took most of the observations in the creep tests.

Schedule of Tests.

Particulars are given in Table I of the mechanical tests carried out on (a) plain specimens of 14% pykrete and (b) jointed specimens of 14% pykrete, the joints consisting of a mortar of 6% or 14% pykrete.

Table/

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Some Mechanical Properties of Pykrete at Temperatures below 0°C.

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(Work performed for D.S.R., Admiralty).
Report submitted by Dr.S.L.Smith, - Superintendent, Engineering Department, National Physical Laboratory.

September, 1943.

Summary.

This investigation was undertaken to determine the mechanical properties of a frozen mechanical mixture of a wood pulp and water. The conditions of the manufacture of the material and the mechanical test procedure were carefully controlled throughout. To a limited extent, the effects of variation of temperature, rate of testing and size of specimens have been found. Owing to the urgency with which results were required, the number of tests of each type has, unfortunately, been restricted, but the results are such that general conclusions as to mechanical strength can be drawn.

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MECHANICAL PROPERTIES OF PYKRETE

FIGS 5 - 7

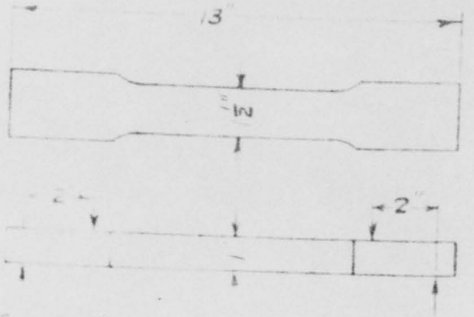

Fig 5 Small Bend Specimen

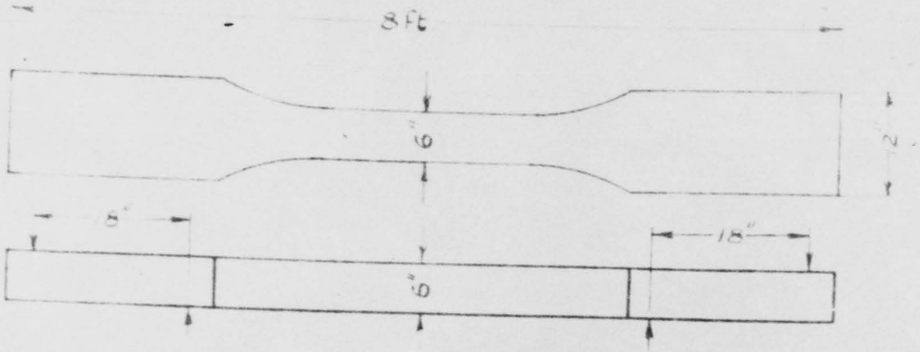

Fig 6 Large Bend Specimen

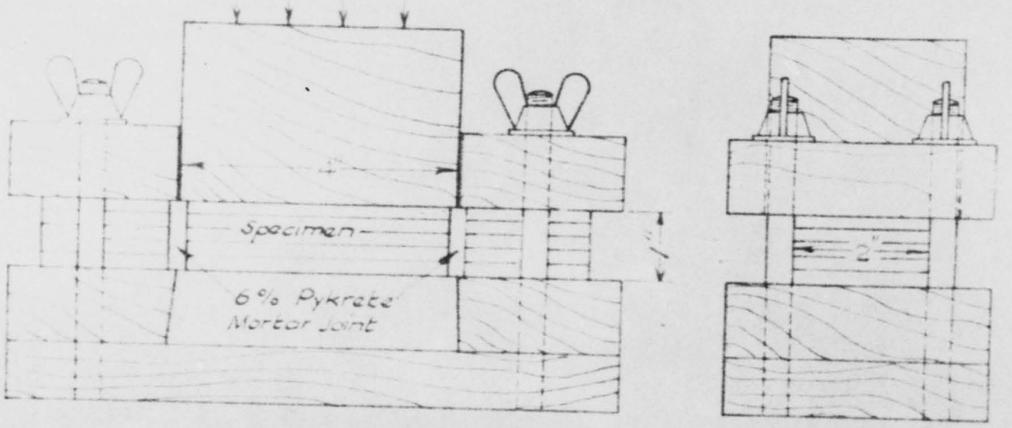

Fig 7 Shear Test Apparatus – Jointed Specimen

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MECHANICAL PROPERTIES OF PYRETE

FIGS 1-4

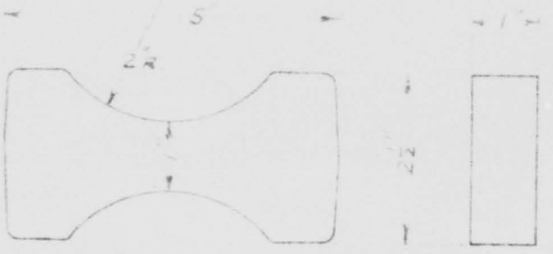

Fig 1 Small Tension Specimen

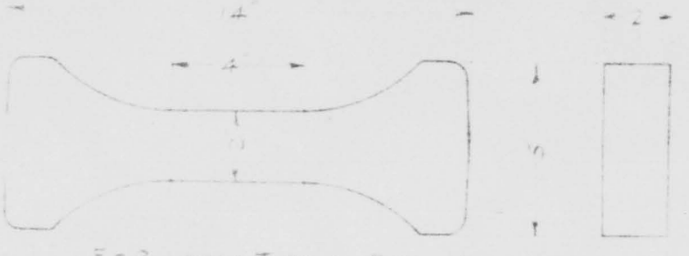

Fig 2 Large Tension Specimen

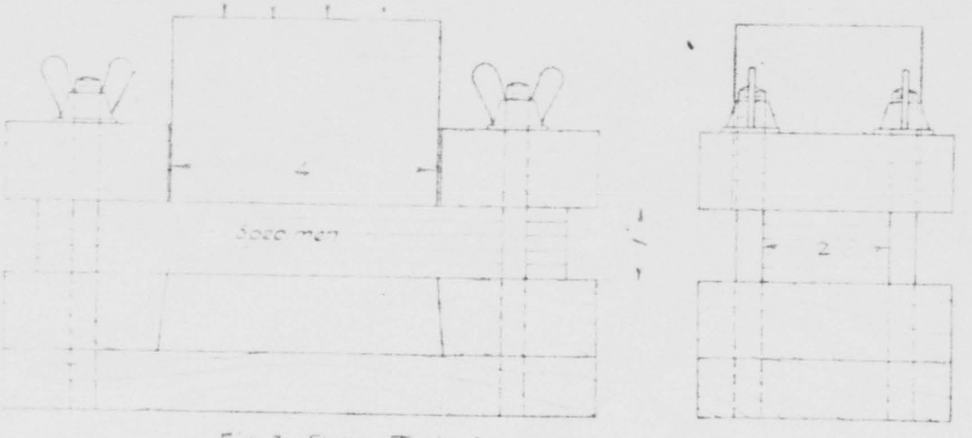

Fig 3 Shear Test Apparatus

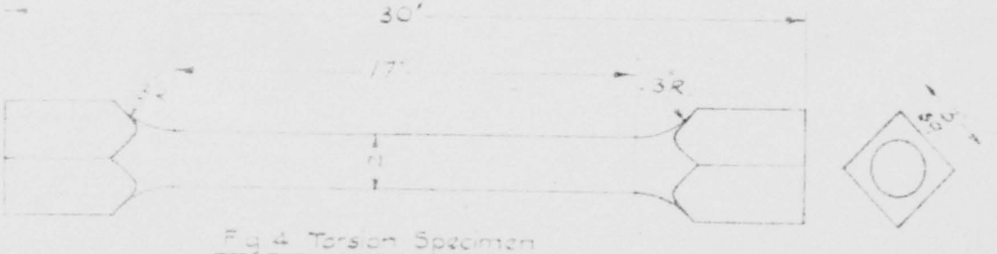

Fig 4 Tension Specimen

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All of the creep curves obtained are of the normal form; scatter of the points in individual curves can be directly associated with temperature variations.

During the course of the investigation, it was observed that pykrete, even when kept at temperatures well below freezing, tended to become dry by evaporation from the surface. The dried surface layer possessed very little mechanical strength. The rate of evaporation would obviously depend upon the temperature and humidity of the atmosphere.

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Table XV

Summary of Moduli Determinations

Modulus determined	Type of pykrete	Temp. of test °C.	Dimensions of section in.	Direction of layers with respect to load	Value obtained lb./sq.in.
Modulus of Elasticity in bending	14%	-15	6 x 6	Parallel	0.78×10^6
	"	-15	6 x 6	Perp.	0.78×10^6
Modulus of Rigidity	"	-15	2.0 diameter	(Parallel to axis)	0.26×10^6
Modulus of Rupture in tension	"	-15	"	"	700
Modulus of Rupture in bending	"	-15	1½ x 1	(no layers)	1600
	"	-15	6 x 6	Parallel	1380
	"	-15	6 x 6	Perp.	1380
do.	Large blocks; 6% hot joints.	-15	12 x 12	-	70
	Large blocks; 6% cold joints.	-15	12 x 12	-	400
	Small blocks; Vertical joints - 6% hot, hor. joints - 14% cold.	-15	12 x 12	-	330

General Remarks.

It is important to bear in mind that in order to obtain reasonably accurate values of the mechanical properties of a material such as pykrete, a large number of tests under each given set of conditions should be carried out. During this investigation, however, time was insufficient for an exhaustive series of tests, and consequently the results obtained should only be regarded as giving an indication of the mechanical properties to be expected.

It can be seen clearly from the results that the rate of testing of the pykrete is an important factor, and it is surprising to note that the tensile strength increases as the testing speed decreases; as creep occurs at low stresses, it is probable that an optimum rate of tensile strain exists. This is possibly due to self-annealing of the ice-crystals taking place at low rates of strain.

The increase of compressive strength with increase of testing speed is in accordance with results obtained in other materials.

In general, the tests appear to indicate the existence of a scale effect, the larger specimens giving somewhat poorer results than the smaller ones except in the case of the compressive creep tests. The evidence on this point is, however, very meagre, and in view of the purpose for which the material has been developed, it is strongly recommended that further tests on a very much larger scale be carried out.

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Table XIII

Results of Creep-Shear Tests on Jointed 14% Pykrete.

Type of Joint	Stress Applied lb./sq.in.	Creep-Shear Rate in 10-6 in./in./hour after 100 hours	200 hours	300 hours	500 hours	700 hours
6% Pykrete Hot (70°C.)	50	3	2	1	<1	<1
	100	4	2	2	2	1
	150	10	5	4	4	4
6% Pykrete Cold (5°C.)	50	9	3	2	2	2
	100	12	10	9	8	7
	150	45	48	48	-	-

SECTION III. Summaries of Mechanical Properties and General Remarks.

Table XIV

Summary of Mechanical Strength Determinations*

Property Determined	Type of pykrete	Temp. of test °C.	Dimensions of section of specimen in.	Direction of layers with respect to load	Ultimate Stress at testing speed of .02 in./min. lb./sq.in.	0.1 in./min. lb./sq.in.	1.0 in./min. lb./sq.in.
Tensile strength	14%	-10	1 x 1	Parallel	790	740	770
	"	-10	"	Perp.	520	300	210
	"	-15	"	Parallel	960	860	760
	"	-15	"	Perp.	490	330	230
	"	-15	2 x 2	Parallel	780	-	610
	"	-15	"	Perp.	180	-	140
	6% hot joint	-15	"	-	620	-	220
	6% cold joint	-15	"	-	440	-	440
Compressive strength	14%	-10	3 x 3	Parallel	680	1110	1380
	"	-10	"	Perp.	850	1080	1560
	"	-15	"	Parallel	1000	1330	2010
	"	-15	"	Perp.	1060	1360	2060
	"	-10	12 x 12	Perp.	-	880	-
Shear strength	"	-15	2 x 1	Parallel	580	-	440
	"	-15	"	Perp.	1090	-	1070
	6% hot joint	-15	"	-	640	-	800
	6% cold joint	-15	"	-	690	-	790
Bond strength with Canadian Spruce	6% hot joint	-15	Timber 1 x 1	-	300	-	390

* Excluding creep test results.

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Table XII

Results of Bond Strength Tests.

Timber used:- rough sawn Canadian spruce
Temperature of Tests:- 15°C.
Type of mortar:- 6% pykrete (applied hot)

Type of test piece	Form of test	Testing speed in./min.	Total surface area of wood in contact with mortar, sq.in.	Bond strength lb./sq.in.	Average bond strength lb./sq.in.
See Fig.8	Tension	0.02	6.6	270	290
			7.2	310	
		1.0	7.8	340	300
			6.8	260	
See Fig.9	Compression	0.02	6.0	330	310
			6.0	330	
			6.0	280	
		1.0	6.0	360	450
			6.0	510	
			6.0	490	

Remarks.

In each test after the maximum load was reached and the bond between the wood and mortar was broken, the load necessary to force the wood from the block fell immediately to a very low value (10% of maximum). In general, separation of the wood and mortar was not complete, small splinters of wood being retained in the mortar.

5. Creep Tests in Shear on jointed specimens.

The specimens used for the tests to determine the rate of creep under shear stress were 6 in. x 2 in. x 1 in. in dimensions, jointed at 1½ in. from each end. The layers of the pykrete were perpendicular to the plane of the joints and to the direction of the load, which was arranged so that each joint was under shear stress. Two machines, each consisting of three simple levers, were constructed for the tests and a photograph of one machine is shewn in Fig.32; a larger scale photograph shewing a specimen in a machine is given in Fig.33.

The tests were carried out in a room the temperature of which was controlled at -15°C. In one machine shear stresses of 50, 100 and 150 lb./sq.in. were applied respectively to specimens in which the joints were of 6% pykrete, formed hot (70°C.). In the other machine, similar stresses were applied to specimens in which the joints, of 6% pykrete, had been formed cold (5°C.).

The load on each specimen was maintained constant for a period of about four weeks, the deflection in each case being noted, from a dial gauge, at regular intervals.

Prior to the commencement of the tests, each specimen was coated with vaseline in order to reduce evaporation from the surface.

The shear-deflection-time curves are shewn plotted in Figs.26 and 27 and creep rates deduced from these curves are given in Table XIII.

Table/

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Table XI.

Results of Bending Tests on Large Jointed Beams.

Test No.	Type of specimen	Dimensions of specimen	Types of joints	Temperature of test: °C.	Modulus of Rupture lb./sq.in.
1	Blocks, 1 ft. cube	12 ft.long, 12 in.wide, 12 in.deep.	6% Pykrete formed cold (5°C.)	-15	400
2	do.	12 ft.long, 12 in.wide, 11.9 in.deep.	6% Pykrete formed hot (70°C.)	-15	70
3	Blocks, 6" x 3" x 2"	12 ft.long, 12½ in.wide, 13⅜ in.deep.	Horizontal - 14% formed cold, Vertical - 6% formed hot.	-15	360
4	do.	12 ft.long 12¾ in.wide, 13½ in.deep	Horizontal - 14% formed cold, Vertical - 6% formed hot.	-15	290

Remarks on Fractures.

In Test No.1, the beam failed at a joint within the central loading span.

In Test No.2, the beam failed at a joint between adjacent outer and inner loading points, i.e. not at a position of maximum stress. The stresses on the face at fracture were about 70 lb./sq.in. bending stress plus 5 lb./sq.in.shear stress.

In each of the above two tests, the fractured surface appeared to be the original block face, covered with an ice layer.

In each of tests Nos.3 and 4, the fracture occurred within the central loading span, and was irregular, passing partly through joints and partly through the small blocks.

4. Tests on strength of bond between timber and 6% Pykrete.

Two types of specimen were used for these tests and are shown in Figs.8 and 9. In each case, a length of 1 in.square section Canadian spruce was embedded with 6% pykrete mortar applied hot, in a block of 14% pykrete. The surface of the wood was rough sawn. The specimens were prepared in a cold room maintained at -15°C.

The specimens shown in Fig.8 in which the wood projects about 18 in. from the block, were tested in a 3 ton testing machine by applying tensile load to the wood; the load was steadily increased until the bond between the wood and mortar was broken, and the wood pulled out of the block.

The test on specimens of the type shown in Fig.9 consisted of applying a compressive load to the wood until the bond was broken, and the wood was pushed through the block.

Tests were carried out at a temperature of -15°C. and at testing speeds of 0.02 and 1.0 in./min.

The results of the tests are given in Table XII.

Table/

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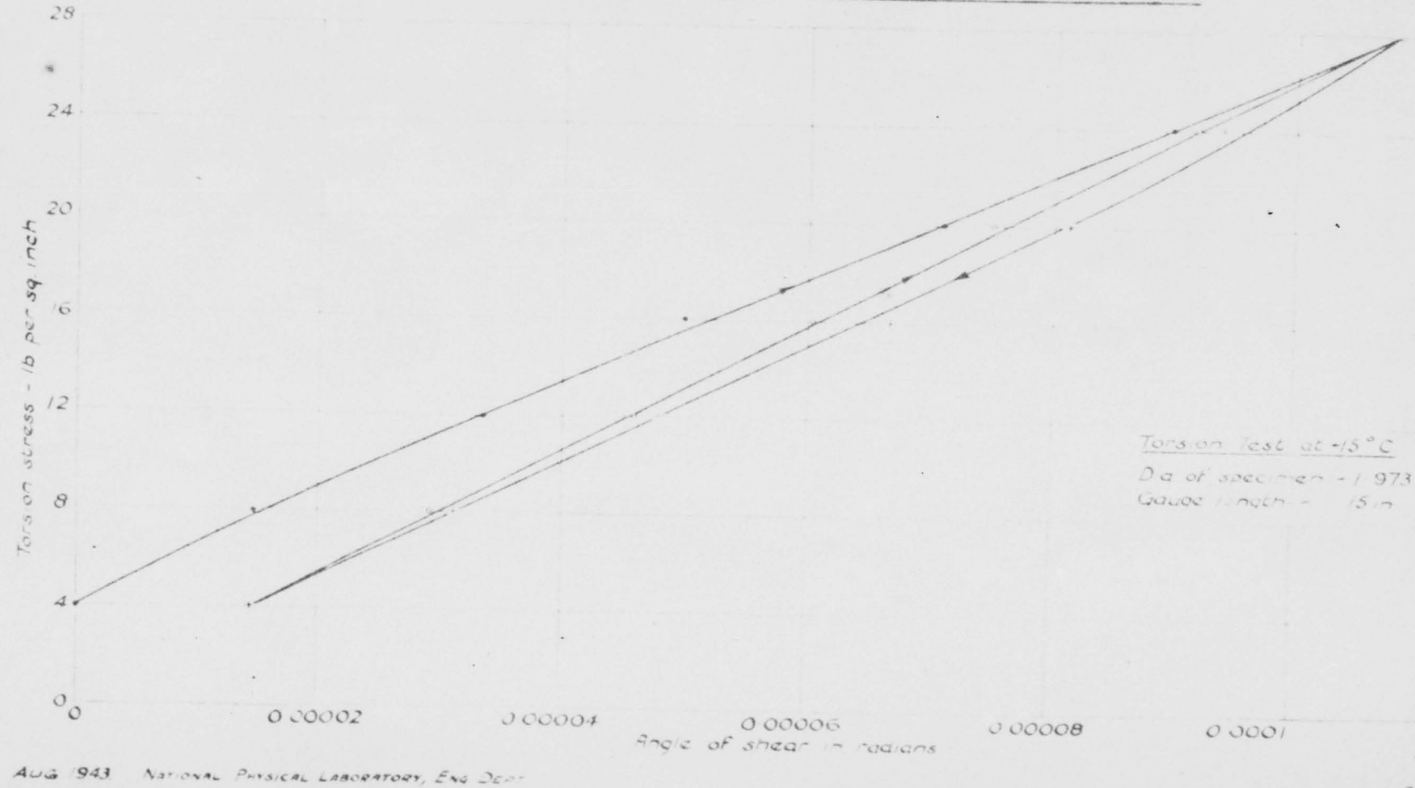
MECHANICAL PROPERTIES OF PYKRETE

Fig 14 Torsion Test on 14% Pykrete – Stress-Strain Curves



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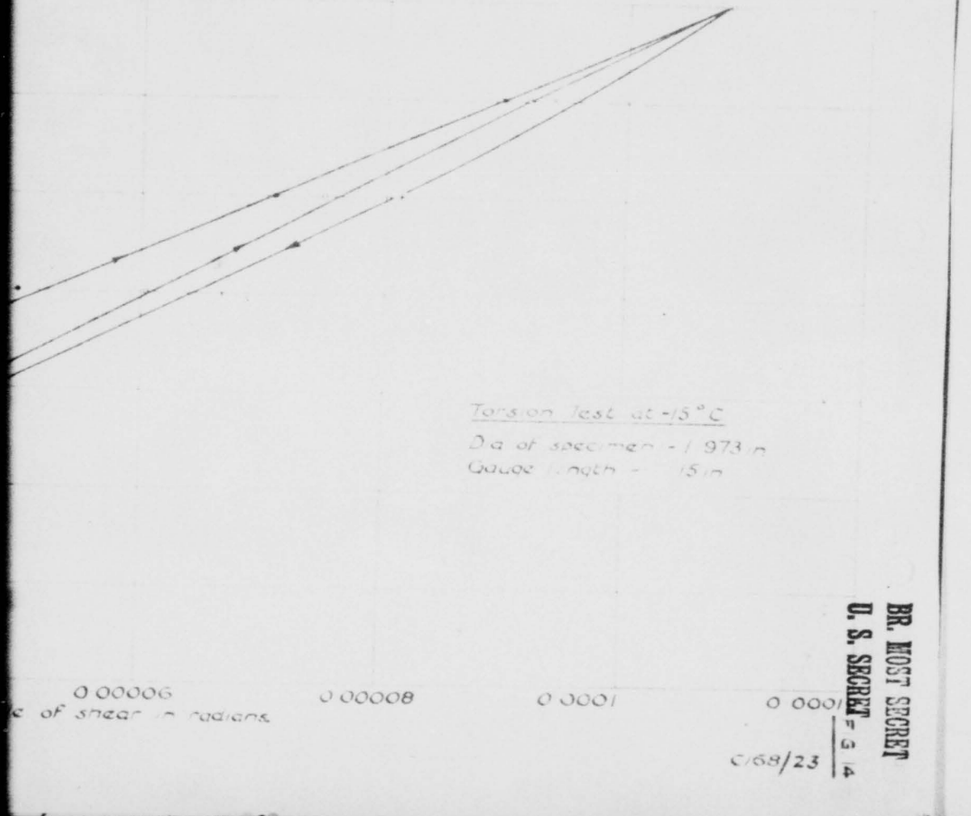
PROPERTIES OF PYKRETE

14% Pykrete – Stress - Strain Curves



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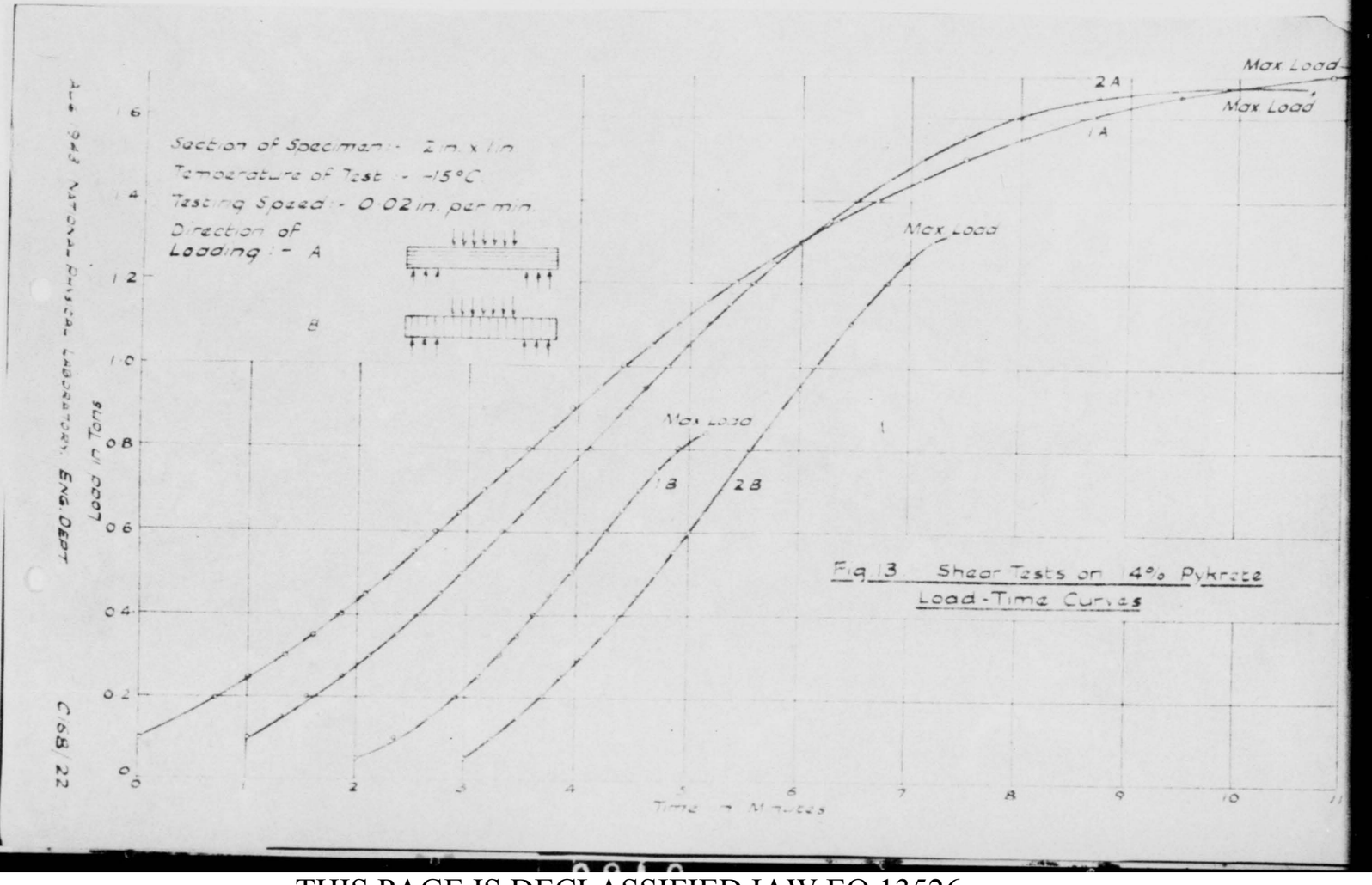

Fig 13 Shear Tests on 4% Pykrete
Load-Time Curves

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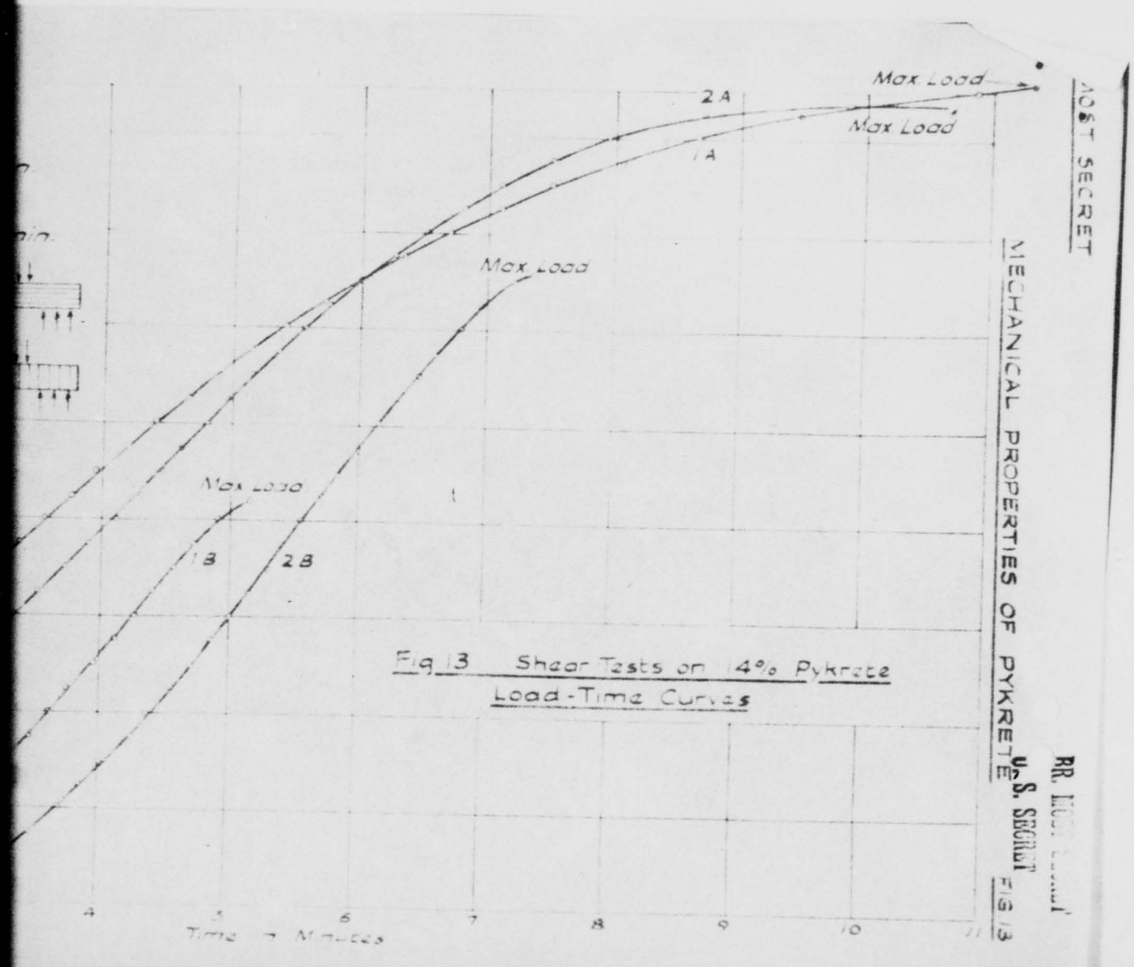

Fig 13 Shear Tests on 14% Pykrete
Load-Time Curves

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MECHANICAL PROPERTIES OF PYKRETE

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FIG 13

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MECHANICAL PROPERTIES OF PYKRETE

Fig 12 Compression Tests on 14% Pykrete - Load-Time Curves

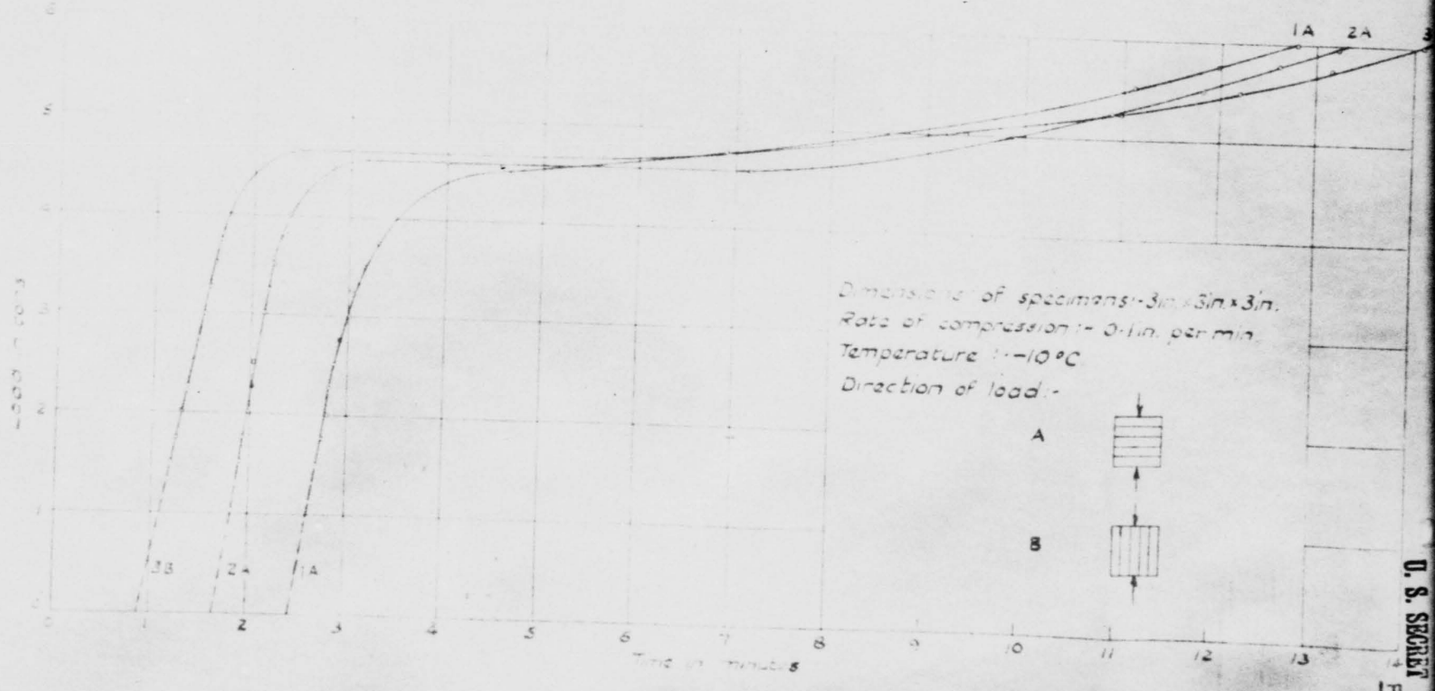

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FIG 12

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MECHANICAL PROPERTIES OF PYKRETE

Compression Tests on 14% Pykrete – Load-Time Curves

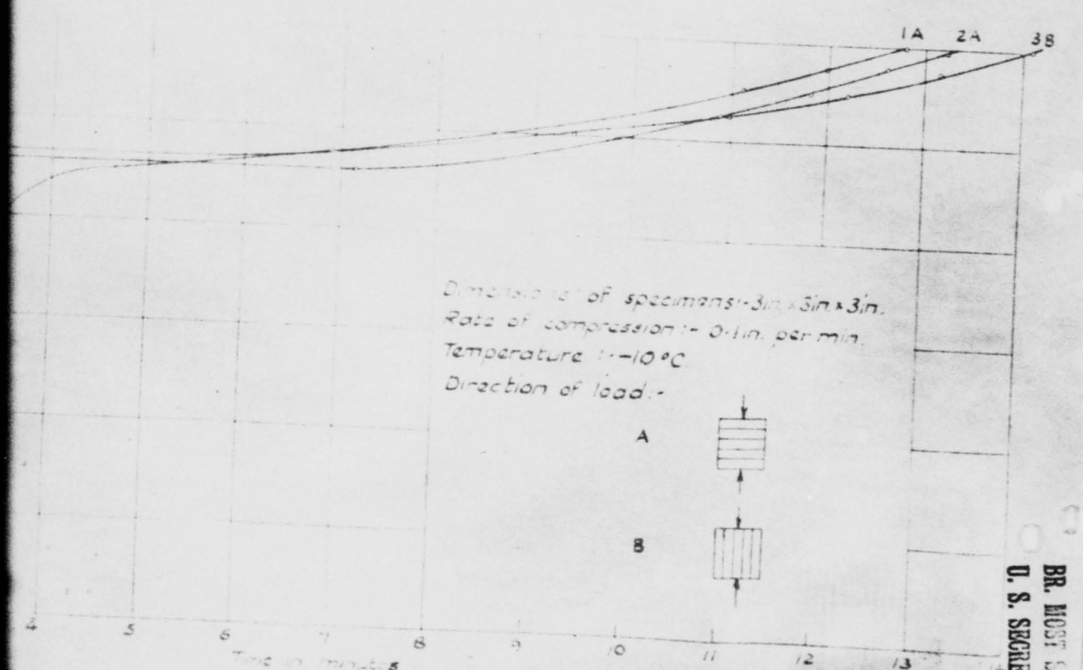

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FIG 12

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MECHANICAL PROPERTIES OF PYKRETE

Fig 11 Compression Tests on 14% Pykrete – Load-Time Curves

Dimension of specimens :- 3 in. × 3 in. × 3 in.
Rate of compression :- 0·02 in per min.
Temperature :- −0°C
Direction of loading :- A

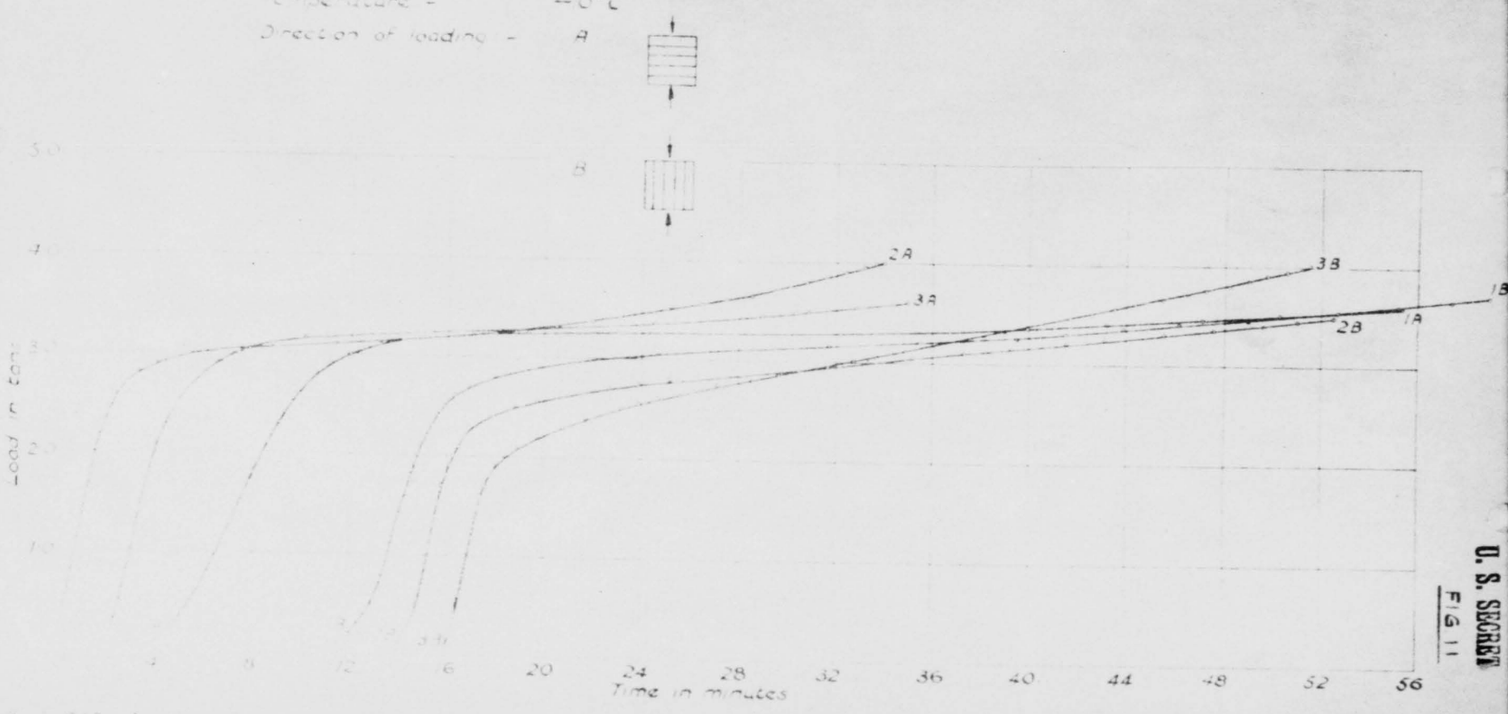

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FIG 11

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MECHANICAL PROPERTIES OF PYKRETE

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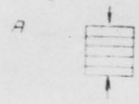
pecimens :- 3 in. x 3 in. x 3 in

ession :- 0·02 in per min.

– 0°C

ading :- A



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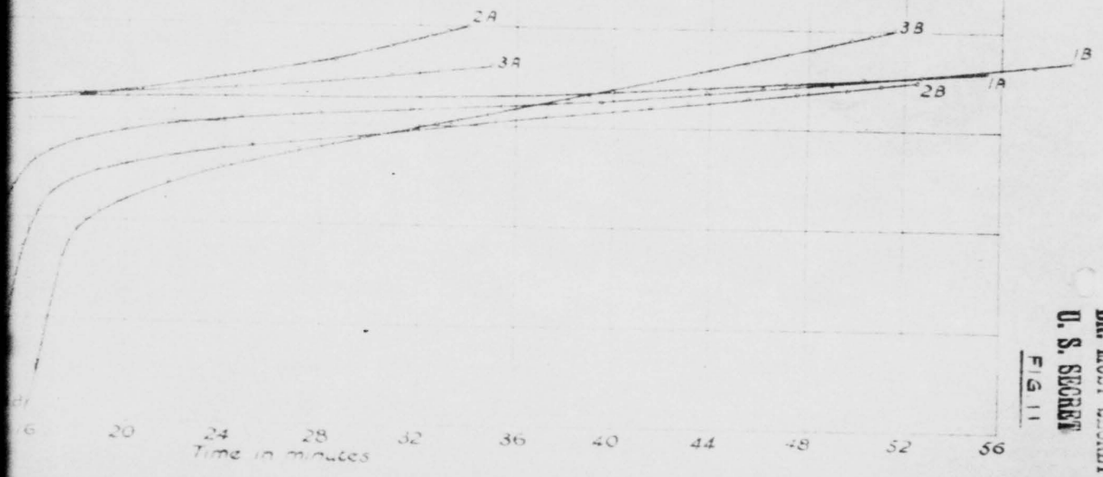

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FIG 11

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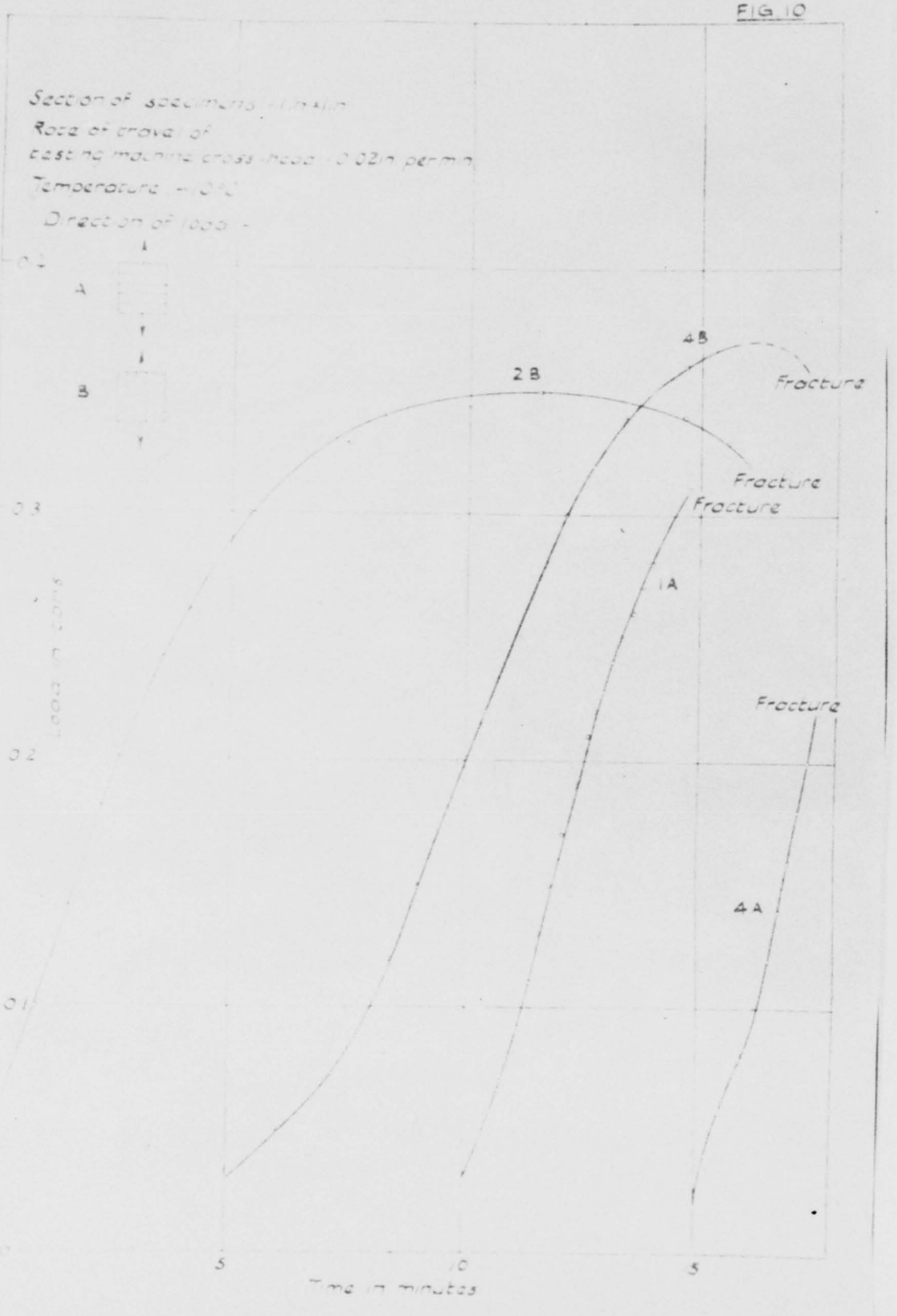
MECHANICAL PROPERTIES OF PYRRETE

Fig 10 Tension Tests on 4% Pykrete — Load-Time Curves

FIG 10



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MECHANICAL PROPERTIES OF PYKRETE

FIGS 8 - 9

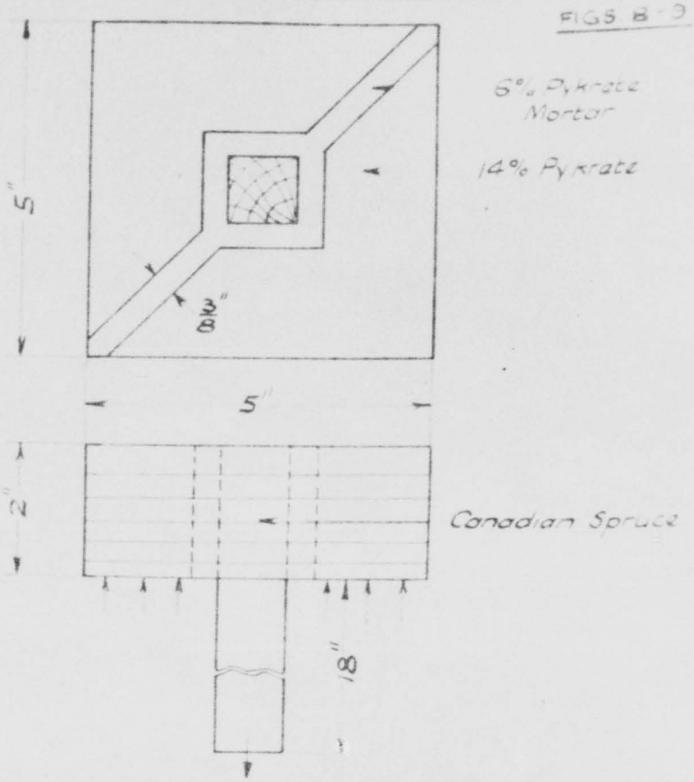

Fig 8 Bond Strength - Tension Specimen

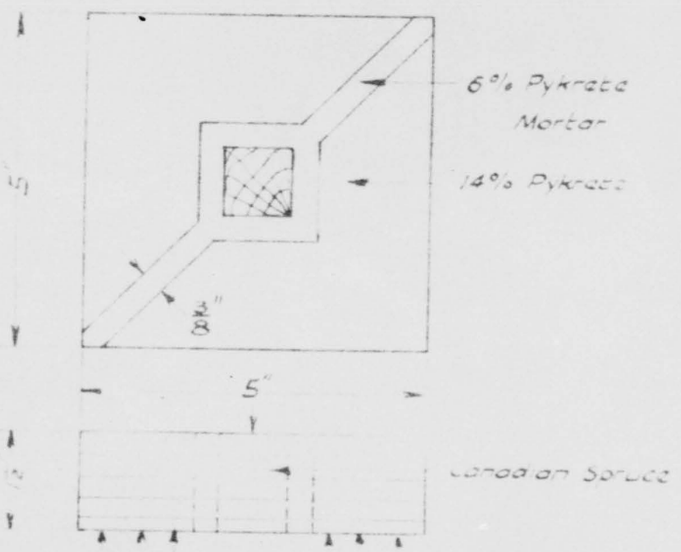

Fig 9 Bond Strength - Compression Specimen

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MECHANICAL PROPERTIES OF PYKRETE

FIG. 20

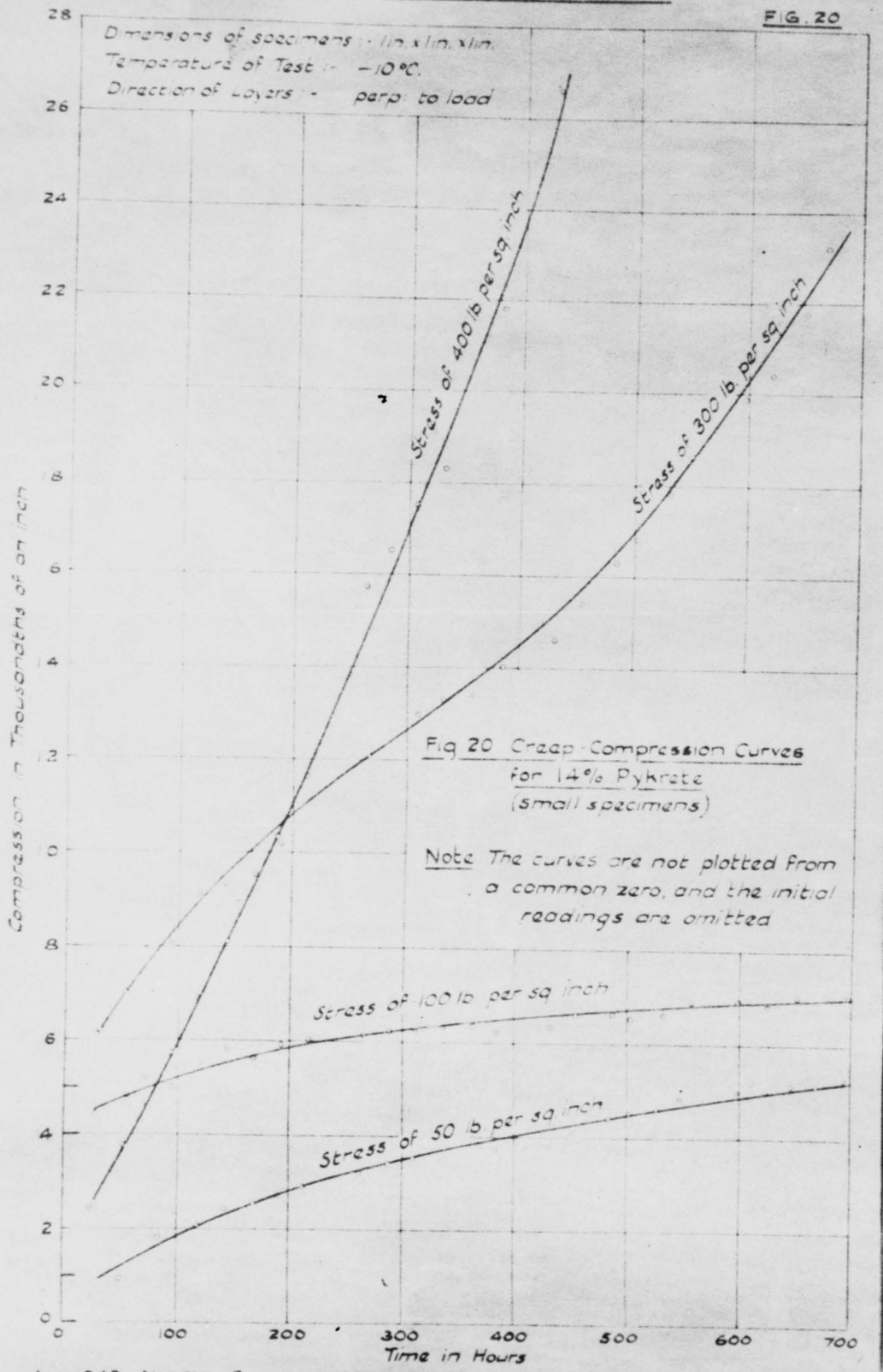

Fig 20 Creep-Compression Curves for 14% Pykrete (small specimens)

Note The curves are not plotted from a common zero, and the initial readings are omitted

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MECHANICAL PROPERTIES OF PYKRETE

FIG 19

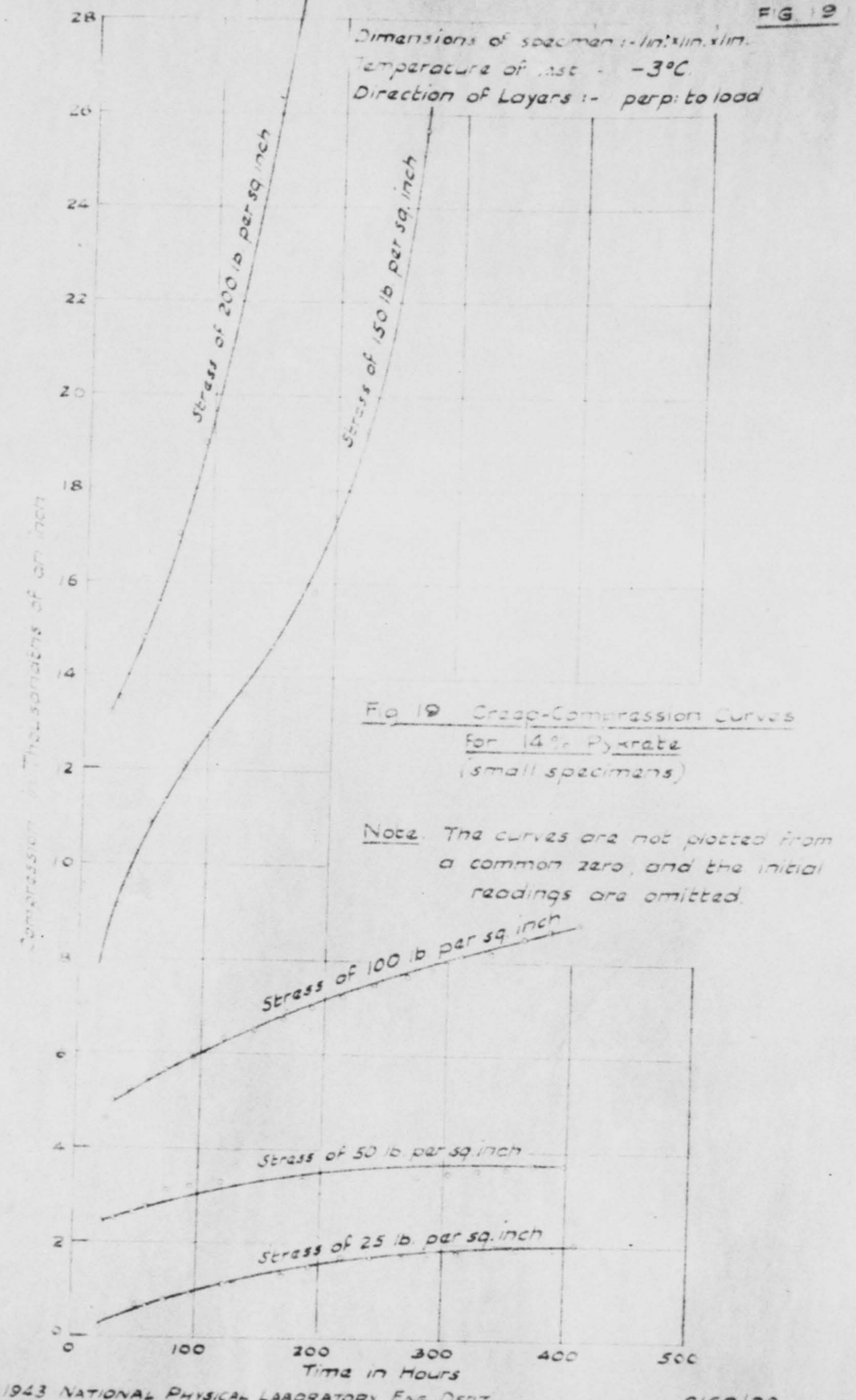

Fig 19 Creep-Compression Curves for 14% Pykrete (small specimens)

Note. The curves are not plotted from a common zero, and the initial readings are omitted.

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MECHANICAL PROPERTIES OF PYKRETE

FIG 18

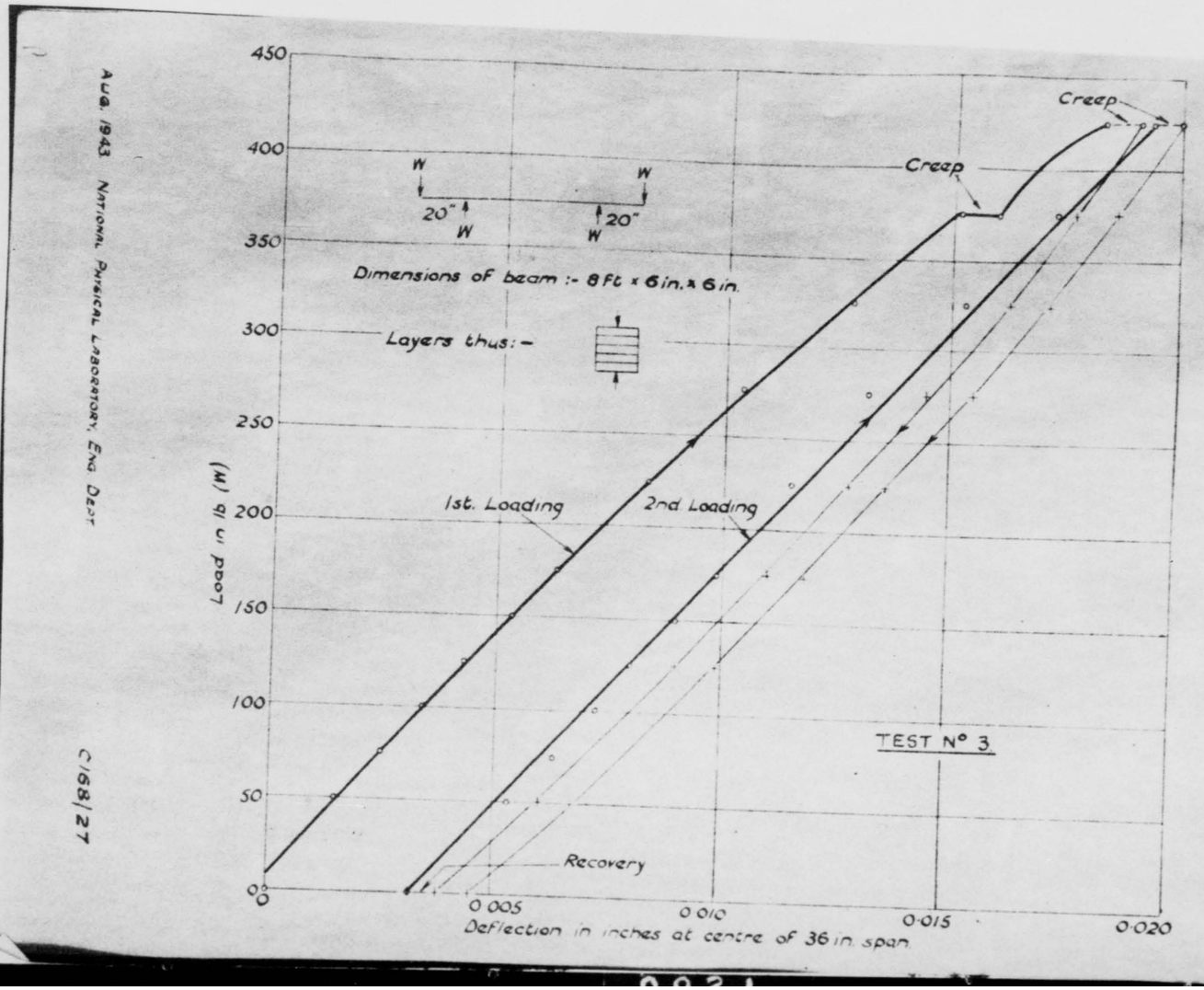

Fig. 18. Bend Test on 14% Pykrete - Load-Deflection Curves

FIG 18

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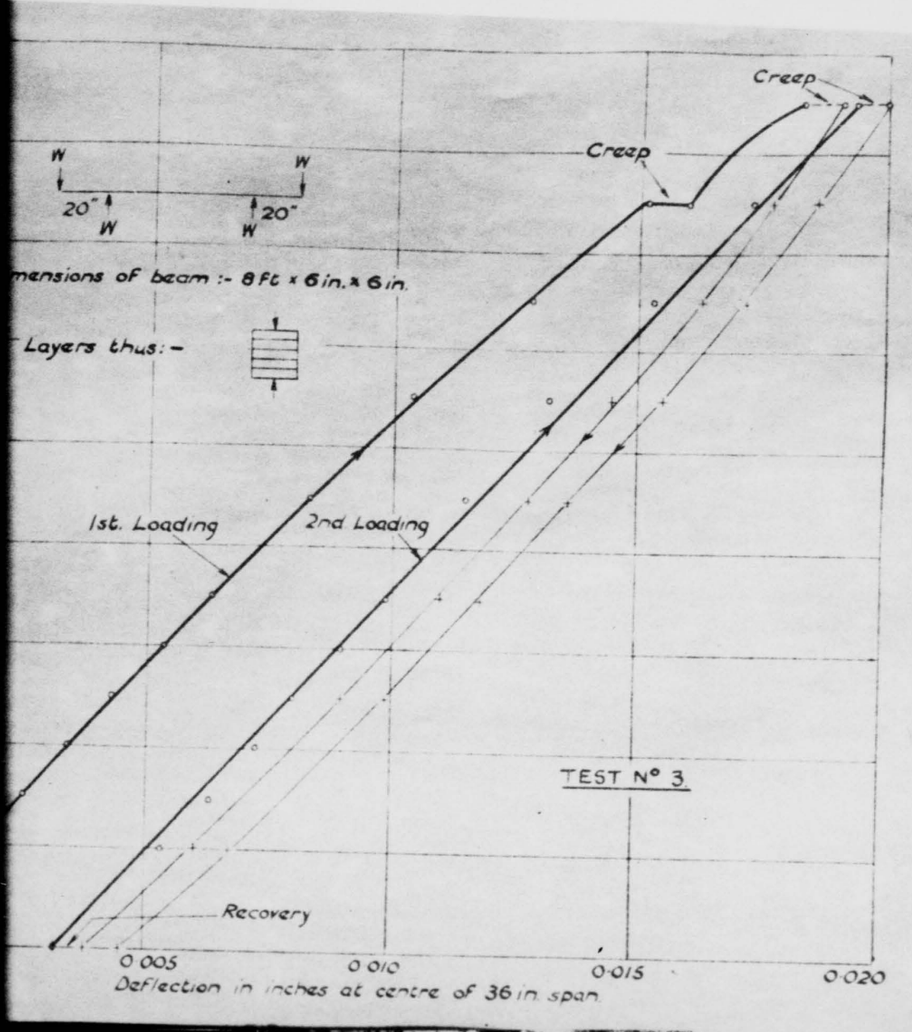

FIG 18

Fig. 18. Bend Test on 14% Pykrete - Load-Deflection Curves

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MECHANICAL PROPERTIES OF PYKRETE

FIG 18

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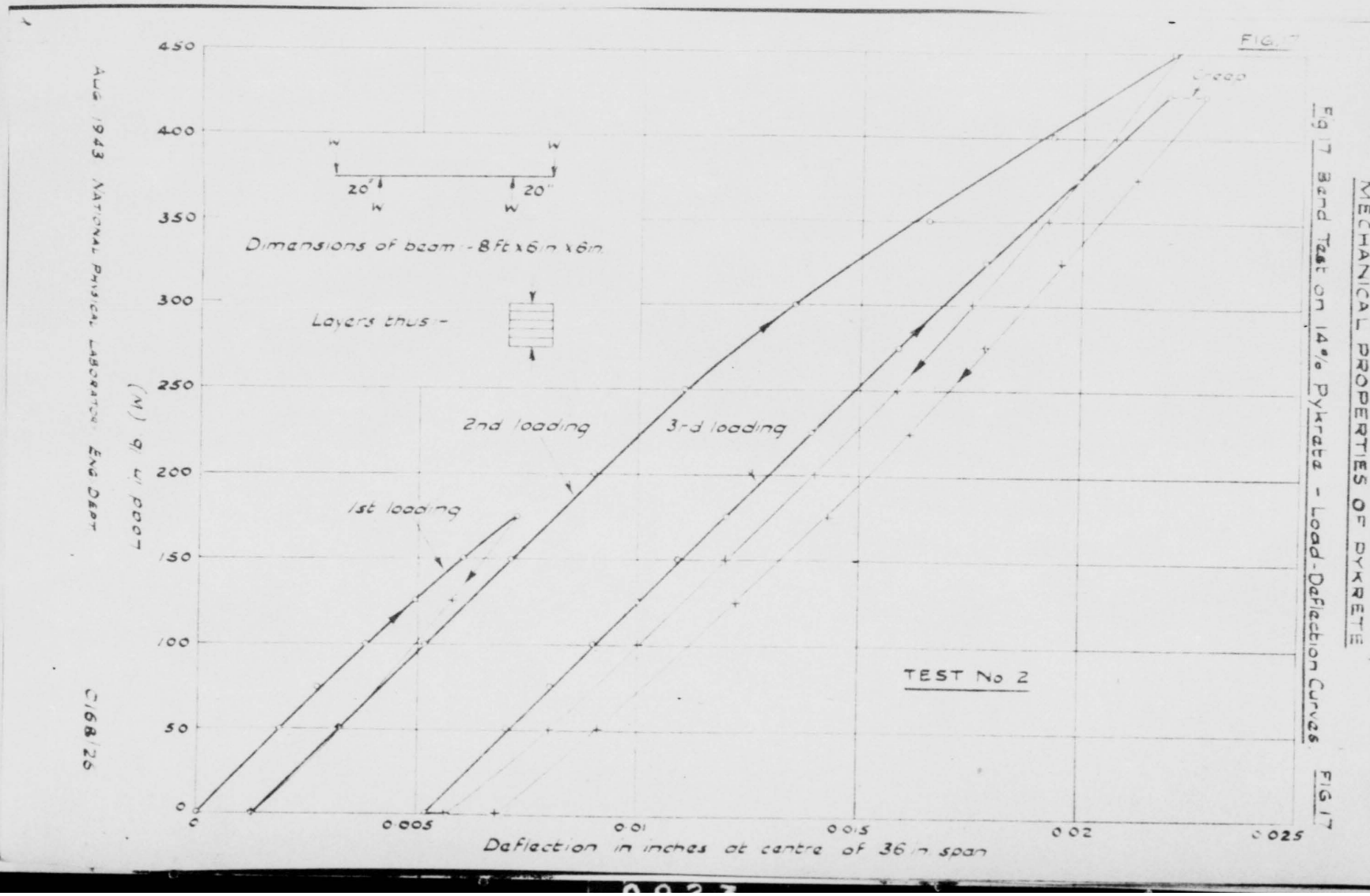

Fig 7 Bend Test on 14% Pykrete - Load-Deflection Curves FIG 7

MECHANICAL PROPERTIES OF PYKRETE

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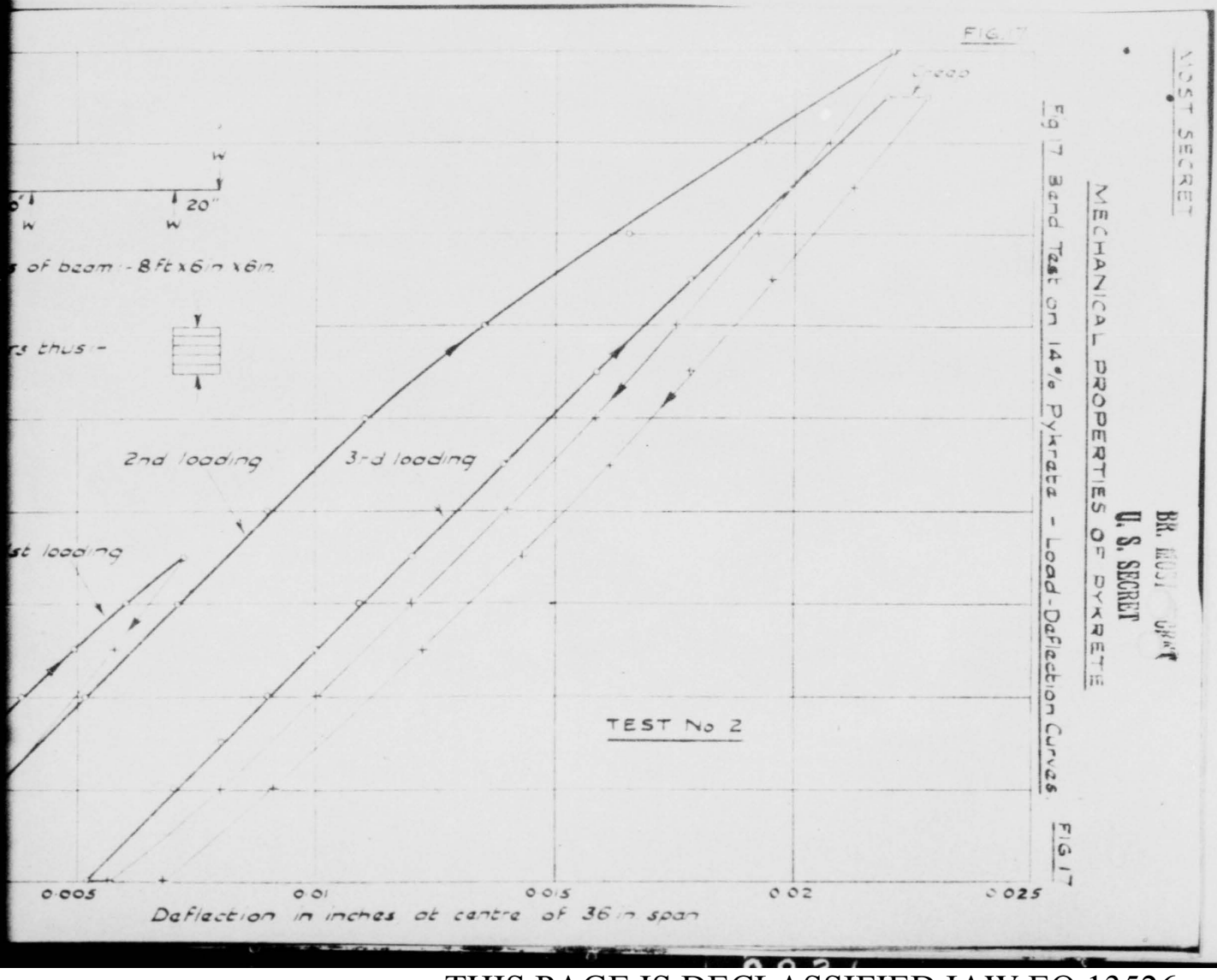

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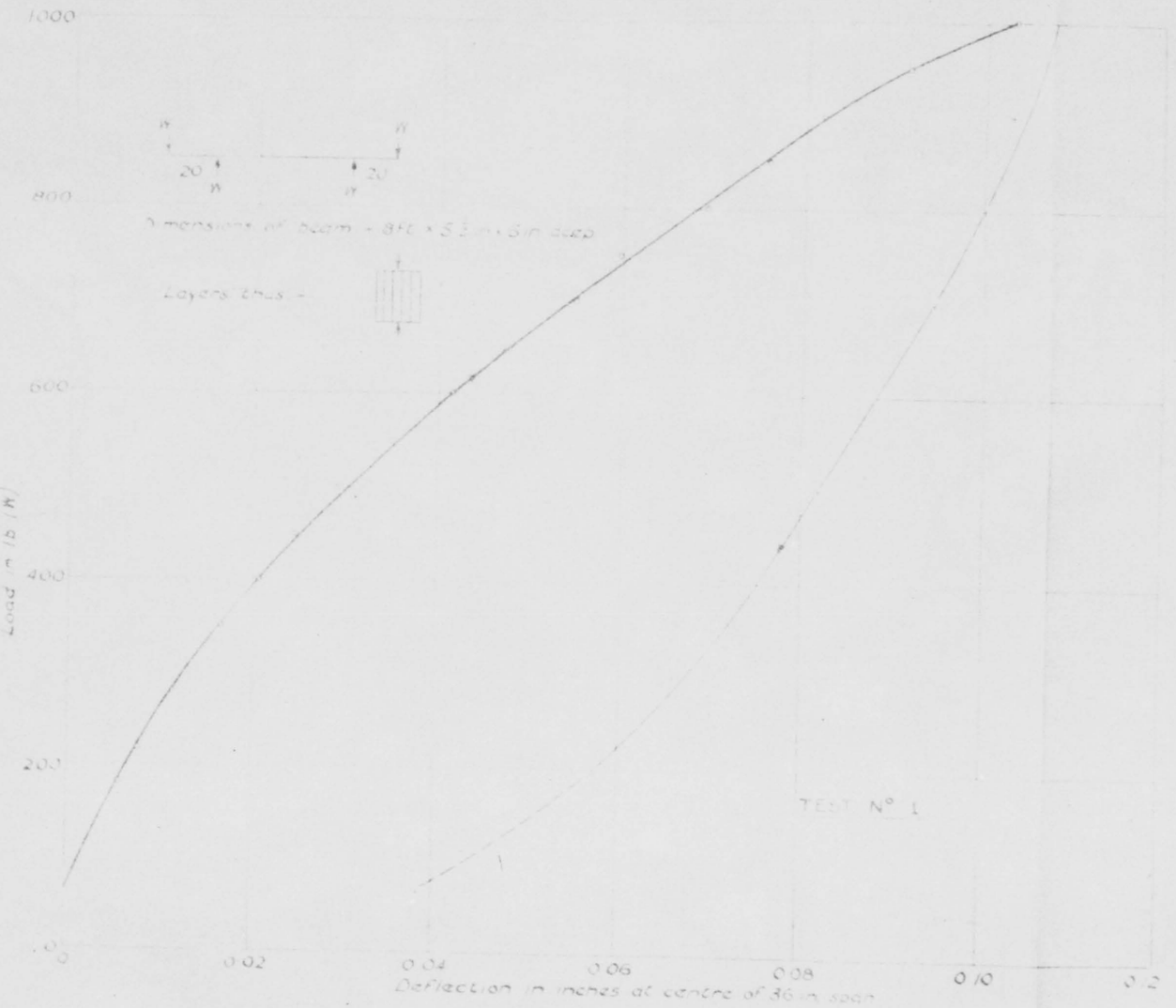
MECHANICAL PROPERTIES OF PYKRETE

FIG 16

Fig 6 Band Test on 14% Pykrete - Load - Deflection Curves



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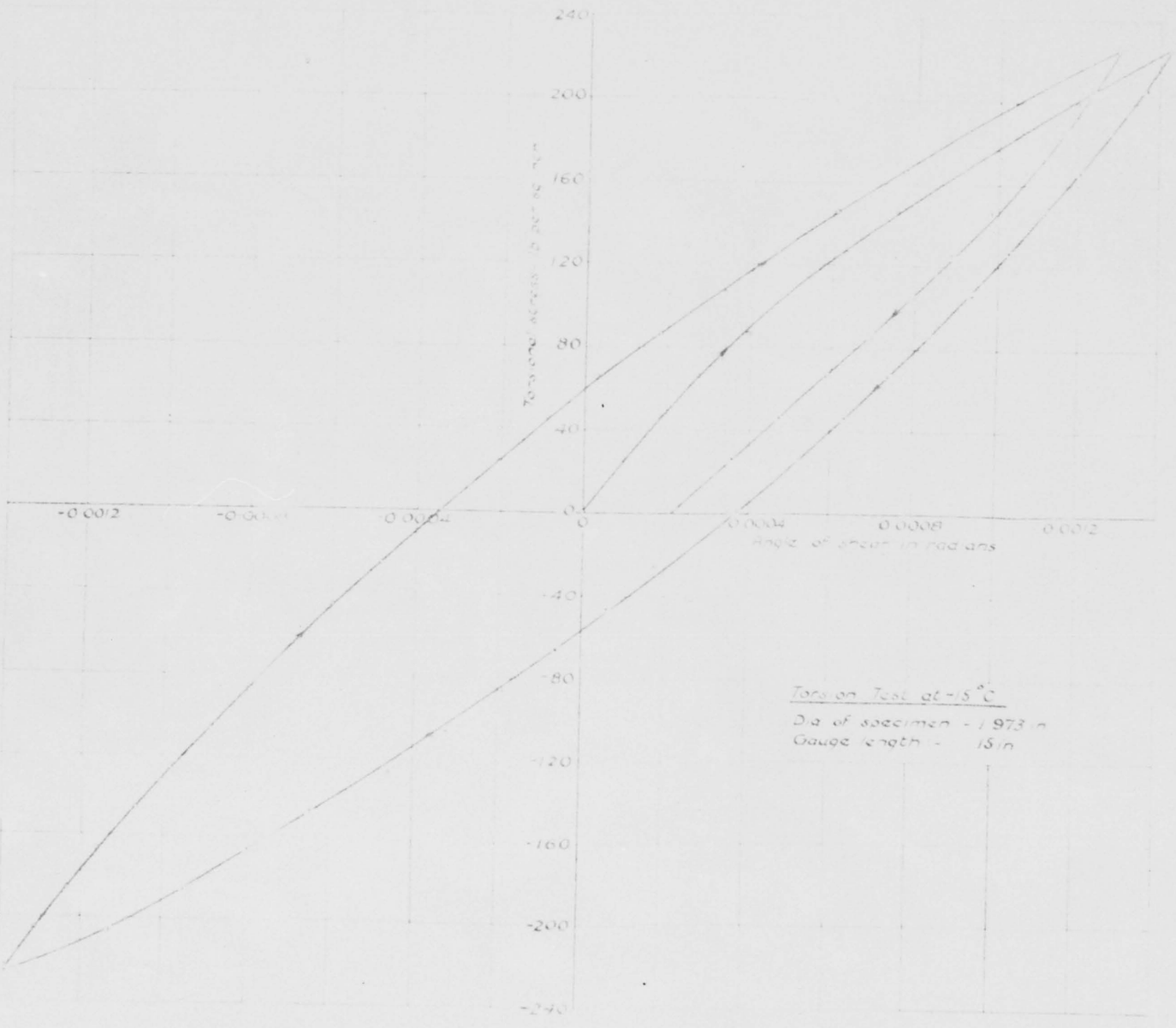
MECHANICAL PROPERTIES OF PYRRETE

Fig 6 Torsion Test on 14% Pyrrete - Stress-Strain Curves



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HABBAKUK II

H/5124

Pykrete Micro-reinforcement

I have been asked to report on the reasons why wood pulp was chosen as a filler or micro-reinforcer for ice in preference to other materials such as bagasse (sugar cane fibre), straw or various grass fibres.

To begin with I should explain that the fundamental work on the micro-reinforcing of ice was begun in July 1942 at the Polytechnic Institute at Brooklyn under the direction of Professor H. Mark and Dr. W. Hohenstein. Dr. Hohenstein tested a very large number of substances including sand, clay, silica, wood flour, felt, burlap, wool, cotton, cellulose pulp, bronze and steel wire. He found that fibrous materials were the most effective reinforcers. The effectiveness did not, however, depend on the mechanical strength of the fibre, but was purely a function of the strength of the bonding between the ice and the fibre, i.e., it depended on whether the fibre was easily and thoroughly wetted. The best results of all were obtained with

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cellulose pulp. The use of bagasse, straw and other grass fibres was considered but not put into practice because the wetting properties of these fibres were thought to be poor.

The reports on Dr. Hohenstein's work were first shown to me last February in London and I was informed that only a material available in very large quantities could be used for our purpose. I decided accordingly that the material known as "mechanical pulp" would be the most promising one, because of its production on a mass scale in Canada and the northern United States, and also because its wetting Properties would be most similar to the cellulose pulp (chemical pulp) used by Dr. Hohenstein. It was furthermore decided by D.S.R., Admiralty that it would be best to develop <u>one</u> satisfactory material whose properties should be thoroughly tested rather than to produce a variety of different materials with possibilities of numerous variations of different mixtures, as it was thought that this was the only way to get to a practical realization of the project in the shortest possible time.

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As it happened "Pykrete", a frozen mixture of wood pulp (mechanical pulp) and water proved to be successful beyond all expectation. We, therefore, saw no reason to try any variation in the composition of the material.

M.F. Perutz

Washington, D.C.
5th October, 1943

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REPORT ON VISIT TO BROOKLYN POLYTECHNIC

October 1st to 4th, 1943

H/5127/

I visited Professor H. Mark and Dr. W. Hohenstein at the Brooklyn Polytechnic and had a full discussion on the research which they carried out during the past year. They showed me the cold store where their materials were prepared and some of their mechanical tests performed, and they also demonstrated the compression testing machines which they had used at the Polytechnic Laboratory itself.

I had the impression that Hohenstein and his collaborators did an excellent job under most trying conditions. Owing to lack of priority their cold store facilities are poor, they have no protective clothing for work at -18°C, and no workshop facilities at all. Worst of all, Dr. Hohenstein, who is almost exclusively responsible for the research, is ignorant of the ultimate purpose of Pykrete and seems to have spent much time in doing experiments of no value to HABBAKUK. I summarized his main conclusions in H252 and H5124, but I should like to draw attention to one or two points which are of particular interest.

(1) Last February, Dr. Hohenstein sent Mr. Pyke a message reporting that he had observed crushing strengths as high as 5,000 lbs. per sq. in. for a material made of cellulose pulp and water. It was on this result that we based our first Pykrete experiments; however when we observed that Pykrete as made by us flowed rapidly at stresses above 1,000 per sq. in. and in fact cannot be crushed at all, we were inclined to disbelieve the figure of 5,000 lbs. per sq. in. I now had occasion to convince myself that this figure was perfectly

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genuine and that Hohenstein really succeeded in making a material which had twice the crushing strength of concrete - at least in one direction. The material is made by wetting sheets of chemical cellulose pulp of about 1/32 of an inch in thickness until a water content of 90% is reached; the wetted sheet is then frozen; the next sheet is then placed on top and frozen again and so forth. When subjected to compression normal to the plane of the layers very little plastic flow is observed until the test piece suddenly collapses when the stress approaches 5,000 lbs. per sq. in. When stressed parallel to the planes of the layers, on the other hand, the material is no stronger than ordinary ice. If the pulp is dispersed uniformly instead of being laid on in the form of prefabricated layers, then the material behaves similarly to our own Pykrete.

Hohenstein believes that the advantages of both materials could be combined by using the right grade of pulp and the laying mechanism envisaged in Thompson's Report, H1964.

(2) AEROPIK (Viscous sponge and water; density 0.5)

This material has very satisfactory properties but Hohenstein doubts that the viscous sponge could be manufactured on a very large scale without interfering with other essential programmes in this country.

(3) PULVOPIK (Mixture of wood-flour and snow, wetted and frozen)

Hohenstein did not succeed in preparing a satisfactory material but believes this to be due to the poor technical facilities at his disposal. He recommends that that problem be taken up by the Canadians who possess all the cold store and workshop facilities required for the purpose.

(4) I should not like to comment on Hohenstein's results and recommendations before having seen the Canadian research.

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SIGNED (M.F. Perutz)

Washington D.C.
October 6th, 1943

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H/5128

H A B B A K U K II

NOTES ON OUTSTANDING PROBLEMS IN RESEARCH AND CONSTRUCTION

Prepared by Prof. J.D. Bernal, F.R.S.

The value of constructing a floating air base of material such as Pykrete is essentially that of simple massive construction using a cheap and abundant material and of minimizing the employing of specialised labour such as required in ship-building. With the proposal to use Pykrete two major questions arise:

(a) Would a vessel made of Pykrete be seaworthy and resistant to enemy attack, and

(b) Could such a vessel be built in a reasonable time, at a cost comparable to that required for achieving the same strategic results by other means.

These two questions have not yet been fully answered, although indications, as a result of nine months intensive research, show that satisfactory answers should be forthcoming.

2. The whole object of the research, development and design proposed for the second year is to turn these experimental indications into full scale experience. This work falls into two main divisions:-

(a) The production of the new material on a large scale and the evolution of methods for using it in large

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scale construction;

(b) The design and construction of a vessel of altogether unusual dimensions.

Both these fields must be vigorously examined at the same time to ensure that a realistic advance is maintained.

PRODUCTION OF PYKRETE

3. So far Pykrete has only been produced in blocks of a few feet in dimension and under semi-laboratory conditions in cold stores. The first necessity is to develop this scale of work to full scale production involving very large quantities. The main difficulty is that in order to ensure rapid freezing comparatively thin layers must be used and this means that the primary units of materials must be in the form of slabs. These thin slabs can, of course, be built up to thicker ones, but this must not involve any serious loss in strength, and the whole process must be made rapid, automatic and cheap. The latest research shows that a simplified paper making technique may be satisfactory. If use is to be made of the comparative cheapness of the major raw materials - water 95%, pulp 5% - it is essential to prove, as soon as possible, that Pykrete can, in fact, be produced at a cost below that of poured concrete. This work is one of production engineering, involving particularly experience in the refrigerating and paper-making industries. The size of the Pykrete blocks actually used in the construction would have to be determined by adjustment between the possibilities of manufacture and the constructional requirements in handling.

MECHANICAL PROPERTIES

4. The mechanical properties of Pykrete made in various ways and with percentages of pulp ranging from 4% to 14%, may be stated to have been sufficiently established by small scale testing, and it is on the basis of these tests that the preliminary designs for the structure have been made. Before starting construction, however, it is essential that the performance of the material in larger masses should be studied. Such masses will necessarily have to be made from blocks

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with or without reinforcement. Large scale creep and bending tests (in extension of those already made) will be required to see whether there are any inherent difficulties in the joints of the structures. It will also be necessary to carry out full scale tests on slabs of material with explosives and projectiles such as bombs and torpedos. All these tests will require to be carried out in the vicinity of wherever it is decided to make Pykrete, and preferably, on the sea where resistance to under water explosions and to wave action can also be tested.

PYKRETE CONSTRUCTION

5. So far Pykrete has only been jointed together in small blocks by hand. Methods of handling and welding together large blocks of Pykrete require to be studied in order to determine the most economical methods of building. This is essentially a specialist job, but owing to the unusual nature of the material, even the method of putting it together cannot be fixed without full scale control trials, and the ideal size of block involves a compromise between small number of operations required for placing large blocks and the comparative ease of handling of small blocks. On the basis of these construction tests, it will be possible to get some estimate of constructional costs and times.

INSULATION AND REPAIR PROPERTIES.

6. One feature in which Pykrete differs from all existing materials is, of course, that it requires to be kept at a few degrees below freezing point, involving the use of insulation and refrigeration. That it is possible to do so in practice has already been shown in the Canadian 1,000 ton ice barge; but there are several outstanding problems in the design of insulation and its method of attachment to the Pykrete hull. Different insulation have to be tried out thermally on

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a large scale and their resistance to weather conditions both in the undamaged state and after being attacked by explosives needs further full scale testing. This involves the use of large areas of Pykrete to which insulation can be attached and through which the refrigeration ducts can be passed. The amount of refrigeration needed can be estimated by calculation, but the actual arrangement of refrigerating ducts, Their performance in practice, and the various difficulties which may be incidental in their use, all require examination at full scale. The problem of repair of insulation and refrigerating system once damaged must also be explored full scale both above and below water.

DESIGN

7. The essential problem of HABBAKUK design is the maintenance of a flying platform 40 to 50 feet above water with a material of specific gravity not much less than that of water. This involves either a construction of large hollow spaces, which is undesirable both from the grounds of safety from enemy attack and on account of the intrinsic difficulty of bridging large expanses with Pykrete slabs; or alternatively the use, for a large part of the vessel, of a material of considerably less specific gravity. Two such materials have been developed; one of a sawdust resin composition, which would seem, on test, to be eminently suitable, but which may cause difficulties in the question of resin supply; though a very crude type would suffice, and the other a variety of Pykrete - Pulvopik - which so far has only been tested on a small scale, but would seem to be promising if it can be made cheaply enough. Until the pulp concentration in the material finally adopted is finalized, it is impossible to proceed far with detailed designs involving stress calculations. Preliminary work shows, however, that it would be possible to get sufficient resistance to any wave likely to be met with outside of a few in the most stormy zones of the ocean, and also to resist enemy attack with nothing but superficial loss. The precise dimensions and lines of HABBAKUK require to be determined in relation to its operational requirements. It is clear that, though constructional problems of making very large HABBAKUK will not necessarily be much greater than those of medium size, they will involve at least proportionally larger amounts of material and labour, and a greater amount of power to propel. It is consequently essential that every possible

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method be explored for reducing the size of the runways to an extent compatible with the essential strategic use as bomber relay stations.

The actual method of building up the ship on floating scows requires to be explored. This would involve the building of a section of the ship of the order of 200 feet in length and can only be satisfactorily effected when the major problems of Pykrete production and construction have been solved.

PROPULSION AND NAVIGATION

8. The propulsion system proposed for HABBAKUK II, which so far only exists on paper, involves the use of separate power nacelles. This requires to be worked out on scale models, particularly in regard to the manoeuvrability of such a vessel, and to the need for fins and rudders, the sizes of which may present considerable constructional difficulties. Alternative methods of propulsion should also be explored.

CONCLUSION

9. It would appear, therefore, that the construction of HABBAKUK II implies large scale development involving a number of different branches of construction and production in refrigerating and constructional engineering and naval architecture. If any results are to be expected in a reasonable time, this work must be carried on at high pressure and on a scale involving the use of considerable labour and materials. Its nature is so diverse that it is particularly important that all its different aspects, which are continually reacting on each other, must be integrated by a competent direction.

Washington, D. C.
September, 1943

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HAWAII-Aircraft Operating /29,
Policy & Doctrine - 1/31/42

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HEADQUARTERS HAWAIIAN DEPARTMENT
OFFICE OF THE DEPARTMENT COMMANDER
FORT SHAFTER, T. H.

9 March 1942.

Subject: Aircraft Operating Policy and Doctrine, Hawaii.

To: The Adjutant General,
War Department,
Washington, D. C.

1. Reference your radio number 1589 February 28th and my radio number 2648 March 8th in reply thereto, there is enclosed herewith a copy of letter from the Commander-in-Chief, U. S. Pacific Fleet, CINCPAC file #A3/3Z, A16/AD (95) Serial 0334, dated January 31, 1942, which establishes the aircraft operating policy and doctrine for the Army and Navy in the Hawaiian Area.

2. This doctrine, published by Admiral Nimitz in the exercise of his unity of command, was prepared after thorough consultation with me and the Commanding General, Hawaiian Air Force. Suggestions made by the Army were embodied in this letter, which provided a sound operating policy for the combined air forces in this Department. One or two minor operational difficulties have developed in recent alerts, but these are rapidly being eliminated.

/s/ DELOS C. EMMONS,
Lieutenant General, U.S. Army,
Commanding.

1 Incls -
Ltr. CINCPAC, #A3/3Z, A16/AD
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CinCPac file no.
A3/YZ
A16/AD/(95)

UNITED STATES PACIFIC FLEET
U.S.S. PENNSYLVANIA, Flagship

Serial 0334

January 31, 1942.

CONFIDENTIAL

From: Commander-in-Chief, United States Pacific Fleet.
Commanding General, Hawaiian Department.
Commandant Fourteenth Naval District.
Commander Patrol Wing TWO.

Subject: Aircraft Operating Policy and Doctrine, Hawaiian Area.

Reference: (a) Joint Action Army and Navy, 1935.

1. Unity of command, as provided for in paragraph 9 (b) (2) of the reference, having been centered in the Commander-in-Chief Pacific Fleet, the following instructions regarding Aircraft Operating Policy and Doctrine in the Hawaiian Area are issued. They are effective at dawn on February 2, 1942, at which time earlier instructions at variance therewith are superseded.

2. Primarily, these instructions consist of clarification and amplification, with some modification, of existing arrangements and understandings. Emphasis is placed on general principles rather than restrictive details, in order that responsible commanders may have maximum freedom in developing and maintaining best effectiveness.

3. Policies, doctrine and instructions herein are not fixed or final. Flexibility is essential for adjustment to changing strategic or tactical situations, to variation in own forces available, and to improved methods and ideas. Suggestions for revision are welcome.

OPERATIONAL CONTROL

4. In all cases herein where operational control is specified, this means responsibility and authority for assigning war tasks, such as search, patrol, objectives, strengths and times. Operational control must be exercised through the responsible commander and not by direct orders to or communication with individual aircraft or units. Operational control does not extend to administration, discipline, training and other prerogatives of direct command. It must be assumed that each responsible commander will keep his organization in the best possible state of war readiness. The closest cooperation and mutual understanding among the various commanders are, however, necessary for most effective and rapid results. Tests and practice for development and polishing of doctrine are essential. Such tests and practice shall be based on mutual prearrangement.

5. For air operations in defense of the Hawaiian area, Commander Patrol Wing TWO shall be known as Commander Naval Base Air Defense. He shall function directly under the Commander-in-Chief Pacific Fleet for these operations. In the absence of the Commander-in-Chief Pacific Fleet, he shall function similarly under the Commandant, Fourteenth Naval District (Naval Base Defense Officer).

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6. The Commander Naval Base Air Defense shall, in addition to command of all patrol squadrons and wings in the Hawaiian area and subject to the provisos of paragraphs 7 and 9 hereafter, have operational control of:

(a) The Army Bomber Command.
(b) All other Navy and Marine aircraft permanently or temporarily based ashore, except fighting planes.

7. Should a situation arise such that close approach of enemy forces to the coasts of the Hawaiian Islands has not been prevented and enemy landing with troops is threatened, the Commander Naval Base Air Defense shall, on being so directed by the Commander-in-Chief, or, in his absence, by the Naval Base Defense Officer, return operational control of the Army Bomber Command at once to the Army Bomber Commander; and he shall also pass to the Army Bomber Commander the operational control of all patrol squadrons and all other naval aircraft under his operational control.

8. The Army Intercepter Commander shall, subject to the proviso of paragraph 9, have operational control of Navy and Marine fighting planes permanently or temporarily based on shore.

9. If, in air raid emergency, and aircraft carrier is in port with her squadrons ashore, Commander Naval Base Air Defense and Commander Intercepter Command shall return operational control of her squadrons to the carrier provided she clears the harbor. Similar procedure shall be followed for cruiser aircraft units.

AVAILABILITY

10. Responsible commanders must keep the maximum number of airplanes in flying condition and the maximum number of flight crews on duty, while making due provision for the fact that strenuous operating requirements will probably continue for an indefinite period. The number of available aircraft in any organization is the resultant of the aircraft that are in flyable condition (while maintenance requirements are being met) and the flight crews ready for duty (while physical fitness is being maintained). The Alertness requirements of the following section apply only to the airplanes that the responsible commander can, on a given date, man in flyable condition while keeping his organization physically and materially competent.

ALERTNESS

11. Alertness requirements are applicable only to available aircraft as discussed and defined in the preceding section on Availability. It is impossible to maintain constant complete alertness. Much less must be scheduled if necessary work and training are to go on and if aircraft organizations are to remain effective. The standards of alertness specified herein are intended to meet the current situation. They are subject to modification with changing conditions and increased experience.

12. Heightened alertness will be especially ordered by the Commander-in-Chief when conditions or information indicate that this is wise, and may occasionally be ordered to avoid the disclosures resulting from over-standaradization. All concerned, whatever their authorized degree of alertness maybe at the time, shall shift in emergency to full alert as rapidly as possible.

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in emergency to full alert as rapidly as possible.

13. As used herein, alert means in all respects ready--fueled, armed and equipped -- to take off in the minimum possible time, which will naturally vary with types and numbers, and with field and ramp arrangements.

14. All available aircraft, except those attached to or under the operational control of the Interceptor Command, shall meet the following alertness requirements:

(a) From twenty minutes before dawn until one and one-half hours after sunrise and from one hour before sunset until dusk: one-half alert and one-half alert on two hours' notice.

(b) During other daylight hours: one-half alert on twenty minutes' notice and one-half alert on two hours' notice.

(c) From dusk until dawn: one-eighth alert on thirty minutes' notice and seven-eighths alert on four hours' notice.

15. Available aircraft attached to or under the operational control of the Interceptor Command shall meet the following alertness requirements:

(a) From fifteen minutes before dawn until one and one-half hours after sunrise and from one hour before sunset until dark: alert. One squadron in the air if important Fleet units are in port (Commander Naval Base Air Defense shall keep the Army Interceptor Commander informed on this point).

(b) During other daylight hours: two squadrons alert. Of the remainder, one-half alert on twenty minutes' notice and one-half alert on two hours' notice.

(c) From dusk until dawn: one squadron alert. Remaining squadrons alert on one hour's notice.

SEARCH

16. Under present war conditions and with current numbers and types of aircraft available in the Hawaiian area, it is necessary to combine the missions of Army and naval aircraft, other than pursuit and fighter types, so as to produce the best effectiveness in both search and striking.

17. Except under special circumstances the general directives are:

(a) Minimum of eighteen Army heavy bombers shall be held for striking. This number will be increased when additional patrol planes and heavy bombers become available. Other available Army bombers of all types shall assist as practicable in the daily search, the remainder being held for investigation and covering of contacts and for striking as practicable.

(b) Commander Naval Base Air Defense shall control and be responsible for the daily search, using naval planes under his

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command or control and with the assistance of Army bombers. The available naval planes that are not detailed for search shall be held for investigation and covering of contacts, for convoy coverage and for striking as practicable.

(c) The numbers of Army and naval aircraft used for search, together with sectors and radii of search, shall be subject to daily adjustment, with the objective always of accomplishing the most effective search with such means as can be employed from day to day. Undue standardization in sectors, distances and times should be avoided in order that enemy information as to our procedure may not be exact. Variation for deception, however, should not be such as unduly to jeopardize the search.

19. Reasonable assistance from radio, radar and lights is needed for airplanes returning from long range search during darkness. Responsible commanders are authorized to employ these aids to the extent necessary, and other activities shall promptly comply with requests for assistance from these aids under their control. Commander Interceptor Command shall have authority in emergency to order extinguished all lights being used for the foregoing purpose.

AIR RAID AND ENEMY CONTACT

20. There are numerous possible variations in time of day or night when an air raid or an important enemy contact may develop, also in the manner and plan of enemy attack, bearing, distance, number and importance of enemy forces and in the position and composition of our own surface forces. Decision and action cannot be fast enough in emergency unless plans, methods and doctrine for typical contingencies are worked out in advance. So that maximum discretion may be kept in the hands of responsible commanders, it is not proposed to lay down herein exact or detailed procedures. It is expected that these will be developed, tested and perfected by the joint cooperation of those concerned. General directives and principles only, some indirectly and some directly associated with the subject, are noted in the following paragraphs.

21. All aircraft not in flight, whether or not available, shall habitually be kept dispersed, protected and concealed as thoroughly as operating and maintenance requirements and available space permit.

22. All flight peronnel shall be kept informed as to the locations and availability for operations of all landplane fields and seadromes in the main Hawaiian group. They shall familiarize themselves as far as practicable by actual landings and take-offs with the various fields and seadromes. Emergency interchangeability of use of these places by Army and Navy aircraft shall be stressed.

23. Damage or destruction of home field runways of planes that are in the air is possible. Air plans should take this into consideration and there should be provision at each field for rapid marking and repair of runway damage.

24. In spite of obstacles, training must continue, both for individual instruction and for drill to perfect air raid and enemy contact procedures. Arrangements should include provision for avoiding misleading radar contacts and for continuing to meet prescribed conditions of alertness. In this connection, aircraft in the air for training and drill may not be counted as alert.

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25. Any suitable U. S. Naval Force at sea will be employed by the Commander-in-Chief Pacific Fleet against enemy contacts. The Commander Naval Base Air Defense should, if circumstances permit, coordinate the employment of shore-based aircraft with the effort of our own surface forces, and Task Force Commanders at sea must accordingly be kept informed by him of type plans that are developed from general directives contained herein. It is of [illegible] importance, however, that no opportunity for attack by shore-based aircraft be [illegible] or neglected, and that attacks be concentrated on major enemy surface objectives, which are as follows in their order of importance: aircraft carriers, battleships, troop transports, cruisers, destroyers.

26. For clarity in anti-aircraft discussion, the following definitions shall apply: An anti-aircraft gun is 3" caliber or above. An automatic weapon is less than 3" caliber.

27. Anti-aircraft gun defense areas shall be specified in detail by the Commanding General, Hawaiian Department, and so promulgated that all Fleet and shore aviation activities are adequately included in the distribution.

28. While the fire of anti-aircraft guns can be positively controlled, this is not the case with automatic weapons, either ashore or aboard ship. They are too widely scattered ashore for other than individual control, and ship control limitations and firing doctrine produce the same result aboard ship. The directive for all automatic weapons must be based on:

(a) Careful training in recognition of friendly and enemy air aircraft.

(b) Opening fire only at enemy aircraft, within reasonably effective range, that are attacking the objective the automatic weapon is designated to defend.

(c) Withholding fire when enemy aircraft in range are being engaged by our own pursuit.

29. There must be a positive and rapid control system for opening fire and ceasing fire of anti-aircraft guns, both Army and Navy. This control shall be exercised by the Commander Interceptor Command, either directly or through his representative, by any suitable arrangement. The system shall provide for anti-aircraft guns not to open fire initially without orders from the above control except when it is clearly evident that enemy aircraft are attacking and friendly fighters or pursuit airplanes in force are not attacking the enemy.

30. During air radi conditions all aircraft, except as noted in paragraph 31 for aircraft of the Interceptor Command and in paragraph 33 (b) (5) for harbor entrance anti-submarine patrol, shall stay out of the air over the anti-aircraft gun defense areas unless definitely informed that it is safe to take off or land within those areas.

31. When, in the judgment of the Commander Interceptor Command during air raid conditions, pursuit and fighter aircraft will be more effective than the fire of anti-aircraft guns over the anti-aircraft gun defense areas, he may have the fire of anti-aircraft guns ceased over all or any part of the gun defense

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areas as necessary for this purpose. When this is done, aircraft of the interceptor Command may fly in pursuit of enemy aircraft over the gun defense areas at any altitude except not below five thousand feet within a radius of one mile from the center of Ford Island. This exception is necessary because of the great number of automatic weapons, both ashore and afloat, in the inner area that cannot be positively controlled but which, because of their density, are highly effective against all aircraft at low altitudes and close ranges.

32. Doctrine for all aircraft in all commands should take cognizance of the following:

(a) Necessity for careful planning and expert handling to avoid vitiating the value of radar information by confusion between own and enemy aircraft.

(b) Actual test and drill covering the various components of plans and doctrines.

(c) Improvement and polishing of communication arrangements, particularly among responsible commanders and to all aircraft, both in the air and at their dispersal points.

(d) Reduction to the minimum, by indoctrination, training and planning, of necessity for orders and instructions during emergency conditions.

(e) Decision, for aircraft not in the air, as to whether and when to take off, depending on degree of warning and circumstances of attack or contact.

(f) Most vigorous possible automatic weapon defense of air fields and seadromes and of aircraft not in the air.

(g) Plans for refueling and rearming, and for using alternative fields and seadromes when home fields and seadromes are denied.

33. Doctrine for aircraft other than those of the Interceptor Command should take cognizance of the following:

(a) Planes engaged in searching:

(1) Continuation of search and to what distance.
(2) Circumstances justifying attack by single plane.
(3) Tracking.
(4) Relief planes for continuation of search and tracking.
(5) Rendezvous points for striking.

(b) Planes on the ground or in the air (not searching).
(1) Rendezvous points for striking.
(2) Adjustment of striking effort to distances, number, importance and authenticity of contacts.
(3) Augmentation of search.
(4) Provision for carrier squadrons to rejoing their carrier, provided she clears the harbor.
(5) Aircraft anti-submarine patrol by readily identified seaplane or amphibian types for ships sortieing from Pearl Harbor (special arrangements essential for safety from anti-aircraft gunfire).
(6) Provision for trailing departing enemy aircraft.

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34. Doctrine for aircraft of the Interceptor Command should take cognizance of the following:

(a) Necessity for holding in reserve a suitable portion of available aircraft to cover the refueling of forces initially employed.

(b) Possibility of diversion of undue effort by preliminary enemy "decoy" attack.

(c) Development (both material and training) of pursuit direction by radar.

(d) Provision for dealing with simultaneous attacks from various directions.

(e) Protection as practicable of:

(1) Striking forces at nearly rendezvous points and other friendly aircraft in the Oahu area.

(2) Striking forces on missions within reasonable pursuit plane radius.

(f) That fighter and pursuit units may be employed at times against ground and surface targets.

C. W. NIMITZ

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Memo for Gen. Tinker

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HAWAII - /30
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AAF/A-WPD

December 13, 1941

MEMORANDUM FOR Brigadier General C. L. Tinker.

1. Pursuant to your request there are submitted herewith an outline of pertinent regulations, directives and related references having a reference to Air Force operations, together with copies of certain papers appended.

a. Outline of Joint Action as Applied to Hawaii:

(1) There is appended hereto a copy of a memorandum under this subject which refers to "Joint Action of The Army and The Navy," "Responsibilities Assigned in Joint Coastal Frontier Defense Plan - Hawaiian Coastal Frontier," and "Standing Operating Procedure, Hq. Hawaiian Department, November 5, 1941." (Inclosure No. 1).

b. Local Defense of Air Bases:

(1) Appended hereto is a copy of AGO letter, under the above subject, dated December 8, 1941, placing into effect the provisions of Training Circular No. 47. (Inclosure No. 2). There is also appended as Inclosure No. 3, a copy of Training Circular No. 47, WD, July 18, 1941.

c. Aerial Reconnaissance Functions of the Army Air Forces in Conjunction with Coastal Frontier Defense:

(1) Appended hereto as Inclosure No. 4 is an AGO letter, October 24, 1941, on this subject. Therein the authority for Army Air Force units in conducting reconnaissance over the sea is prescribed.

d. Joint Action of the Army and the Navy:

(1) The following paragraphs of the above action are noted below as authority in which you will have a primary interest:

(a) Chapter II, Coordination of Operations of the Army and of the Navy:

(1) This chapter outlines the two methods

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for coordination which consist of "Mutual cooperation," and "The exercise of unity of command." The Army Air Forces in Hawaii are now operating under the latter method whereby the Navy coordinates and controls all bombardment operations in attacks over the sea and pursuit operations designed for specific protection of naval units.

(b) Chapter III, Paragraph 19, Coastal Frontier Defense:

(1) Attention is invited particularly to Paragraph 19c, d, e and f, which prescribe the specific Army and Navy functions. Particular attention should be given to Paragraph 19g (1) (a), which charges the Navy with providing and operating system of off-shore scouting and patrols to give timely warning of an attack.

(c) Chapter IV, Functions of Army and Navy Air Components:

(1) This chapter is of interest in outlining functions and responsibilities of the air components

(d) Chapter V, Coastal Frontier Defense:

(1) Attention is invited to Paragraph 26g which "An offshore patrol." This should be considered in connection with Inclosure No. 4, which specifies the "Aerial Reconnaissance Functions of the Army Air Forces," etc.

(2) Note Section 3 of Chapter V, which outlines the several categories of defense. These categories are referred to in Rainbow plans.

(3) Paragraph 32f, Chapter V, should be noted particularly as it deals with the relation of the Army Air Forces to coastal frontier defense. Of particular interest are the functions and operations which are quoted from J. B. No. 349 and appear in small print within this particular paragraph.

2. Joint Army and Navy Basic War Plan:

(1) It is suggested that you look through "Joint Army and Navy Basic War Plans, Rainbow No. 5," Division No. 1," prior to your departure. A copy is available in Hawaii.

(2) Attention is invited to Paragraph 48 which outlines

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joint plans to be prepared and to Paragraph 9, Page 8 of Annex No. 1, which outlines the Hawaiian Coastal Frontier and is followed by a map.

(3) A plan for the employment of bombardment aviation in the defense of Oahu was transmitted to the Chief of the Army Air Forces by General Marshall on August 14, 1941. This is an excellent plan and you will doubtless like to review it upon your arrival in Oahu.

(4) It is suggested that you carefully review the "Standing Operating Procedure" which is a mimeographed document outlining the methods of alert and the responsibilities in conjunction therewith of the forces in Hawaii. This should be reviewed with particular reference to the defense of air bases as outlined in Training Circular No. 47, appended.

f. Joint Coastal Frontier Defense Plan - Hawaiian Coastal Frontier:

(1) Prior to your departure, it is suggested that you secure and look over the above plan with particular reference to Annex No. VII, Section VI, with reference particularly to Paragraph 2 thereof covering joint air operations. The substance of these recommendations is outlined in Inclosure No. 1.

K. M. Walker,
Lieut. Colonel, A. C.

4 Incls:
Cpy memo "Joint Action, Army and Navy."
Cpy ltr "Local Defense of Air Bases" 12/8/41
Cpy Training Circular No. 47
Cpy ltr "Aerial Reconnaissance Functions," etc, 10/24/41.

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1. Pursuant to your request, the following information and data are submitted relative to Army and Navy responsibility in defense of the Hawaiian Coastal Frontier.

2. RESPONSIBILITIES ASSIGNED IN "JOINT ACTION OF THE ARMY AND THE NAVY".

a. Army.

"Par. 19c. The specific functions of the Army in coastal frontier defense are:

"(1) To provide and operate the mobile land and air forces required for the direct defense of the Coast.

"19d(2) Aircraft operating in support of harbor defense; in general coastal frontier defense; in support of or in lieu of naval forces."

b. Navy.

"Par. 19f. The specific functions of the Navy in coastal frontier defense are:

"(2) To conduct naval operations directed toward the defeat of an enemy force in the vicinity of the coast.

"(3) To support the Army in repelling attacks on coastal objectives."

"19g(1)(a). In carrying out these functions the Navy will:

Provide and operate - A system of offshore scouting and patrol to give timely warning of an attack, and in addition, forces to operate against enemy forces in the vicinty of the coast.

3. RESPONSIBILITIES ASSIGNED IN "JOINT COASTAL FRONTIER DEFENSE PLAN - HAWAIIAN COASTAL FRONTIER - Rev. of HCF-41, 20 August, 1941."

"Annex No. VII, Sec. VI, Joint Agreements, 28 March, 1941, Joint Security Measures, Protection of Fleet and Pearl Harbor Base." "II Joint Air Operations.

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Inclosure No. 1

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"2. When the Commanding General of the Hawaiian Department and the Naval Base Defense Officer (The Commandant of the 14th Naval District), agree that the threat of a hostile raid or attack is sufficiently imminent to warrant such action, each commander will take such preliminary steps as are necessary to make available without delay to the other commander such proportion of the air forces at his disposal as the circumstances warrant, in order that joint operations may be conducted in accordance with the following plans:

Army Responsibilities.

"b. Defensive air operations over and in the immediate vicinity of Oahu will be executed under the tactical command of the Army. The Naval Base Defense officer will determine the Navy fighter strength to participate in these missions --------."

Navy Responsibilities.

"c. Joint air attacks upon hostile surface vessels will be executed under the tactical command of the Navy. The Department Commander will determine the bombardment strength to participate in the mission."

"c. When Naval forces are insufficient for long distance patrol and search operations, and Army aircraft are made available, these aircraft will be under the tactical control of the Naval commander directing the search operations."

"d. In the special instance in which Army pursuit protection is requested for the protection of friendly surface ships, the force assigned for this mission will be under the tactical control of the Naval commander directing the search operations.

4. STANDING OPERATING PROCEDURE, Hq. HAWAIIAN DEPARTMENT, Nov. 5, 1941.

a. This document outlines three alerts as follows:

Alert No. 1. "This alert is a defense against acts of sabotage and uprisings within the islands, with no threat from without."

Alert No. 2. "This alert is applicable to a condition more serious than Alert No. 1. Security against attacks from hostile sub-surface, surface and aircraft, in addition to defense against acts of sabotage and uprisings, is provided."

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Alert No. 3. "This alert requires the occupation of all field positions by all units, prepared for maximum defense of Oahu and the Army installations on outlying islands.

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WAR DEPARTMENT
The Adjutant General's Office
Washington

October 24, 1941

AG 580.81 (10-13-41) MC-C-M

SUBJECT: Aerial Reconnaissance Functions of the Army Air Forces in Conjunction With Coastal Frontier Defense.

TO: The Chief of Staff, GHQ
The Chief of the Army Air Forces;
The Commanding Generals,
Armies; Defense Commands; and
Departments.

1. The Army Air Forces are required to perform such reconnaissance over the sea as deemed necessary to their combat efficiency. All Commanders concerned may direct such reconnaissance at their discretion. Whenever missions of this character are performed, they will be referred to as "tactical reconnaissance."

2. The term "off-shore patrol" refers to a part of Naval local defense forces operating and patrolling the coastal zone outside of those areas assigned to the in-shore patrol. Hence, an off-shore patrol is a Naval function. To avoid any infringement upon Naval functions, commanders concerned will refrain from referring to their tactical reconnaissance as off-shore patrol.

By order of the Secretary of War:

s/ E. S. Adams
Major General
The Adjutant General

COPIES FURNISHED:

The Chief of Naval Operations.

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INCLOSURE No. 4

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Army & Navy Responsibility - Hawaii - Memo for Mr. McCloy /31

145.81-168

10 Dec 1941

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Hawaii - Memo for Mr. McCloy

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Army & Navy Responsibility - Hawaii - Memo for Mr. McCloy /31,

145.81-168

10 Dec 1941

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Army & Navy Responsibility - Hawaii - Memo for Mr. McCloy /31

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MEMORANDUM For Mr. McCloy, Assistant Secretary of War.

Army, Navy Responsibility - Hawaii

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KNW/aa

December 10, 1941

(1)

MEMORANDUM For Mr. McCloy, Assistant Secretary of War.

1. Pursuant to your request, the following information and data are submitted relative to Army and Navy responsibility in defense of the Hawaiian Coastal Frontier.

2. RESPONSIBILITIES ASSIGNED IN "JOINT ACTION OF THE ARMY AND THE NAVY".

a. Army.

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b. Navy.

"Par. 19f. The specific functions of the Navy in coastal frontier defense are:

"(2) To conduct naval operations directed toward the defeat of any enemy force in the vicinity of the coast.

"(3) To support the Army in repelling attacks on coastal objectives".

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Provide and operate - A system of offshore scouting and patrol to give timely warning of an attack, and in addition, forces to operate against enemy forces in the vicinity of the coast.

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"a. Joint air attacks upon hostile surface vessels will be executed under the tactical command of the Navy. The Department Commander will determine the bombardment strength to participate in the mission".

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Alert No. 3. "This alert requires the occupation of all field positions by all units, prepared for maximum defense of Oahu and the Army installations on outlying islands".

b. It is apparent that the Hawaiian Department was operating under the "Alert No. 1" prior to the attack.

K. M. Walker,
Lieut. Col. A.C.
The Air Staff

Orig. to Asst Sec. War for Air
1 Copy to Gen. Arnold
Copy for AAF P.D. file

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TO BE RETURNED
TO THE ARCHIVES
OF THE AAF
HISTORICAL
24 Oct 1942
FILE NO. 145-81-17

Sketch of projected trans-Siberian
Ferry Route by Col. Alva
Harvey, AC

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DOD DIR 5200.9

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C.G.A.A.F. for the
A.C. of S., A-2
10/24/42

INTELLIGENCE SERVICE
U.S. ARMY AIR FORCES
WASHINGTON, D.C.

Date October 24, 1942

TO: _____

TRANSMITTED herewith is a
Summary of (interview with: Colonel Alva Harvey, A.C.
Chief, Ferry Route Mission to Russia

Area or theater: Siberia and European Russia

Remarks: Sketch of projected trans-Siberian Ferry Route; remarks on the landing fields; supplies; communications; Russian equipment, new dive-bomber; Joint operations - logistics.

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invariably, "They will tell you in Moscow," and upon arrival in Moscow, the answer was, "We have plenty." The same set answers were given on questions pertaining to servicing arrangements and daily capacities.

Over the entire route - with the exception of a few drums and several old gasoline trucks (about 300 gallon capacity), no storage facilities were seen. In the entire area - i.e. to Krasnoyarsk and in particular, northeastern Siberia - the country was densely wooded and, at no place, was there any sign of a roadway except in the vicinity of Yakutsk. Colonel Harvey feels that if the gasoline and food supplies are not already on hand, it will be impossible to get them there during the winter. Supplies in this entire area are brought down through the various river systems from the Arctic, which can be done only in the summertime, (limited to 2½ months per year). No evidence was found of tractor-drawn sledges and it is not believed that passage of such transport would be possible through the densely wooded area.

Should it be true that the Soviets have adequate supplies over this route, Colonel Harvey does not believe that there will be much difficulty in flying pursuit aircraft across Russia. Snow removal or rolling equipment is available at all airports.

During the winter time there is only four hours duration between sunrise and sunset, however, a long twilight extends the total hours of light to seven.

RUSSIAN EQUIPMENT

Colonel Harvey was told that the Russians have heaters (for cold weather starting) at various stages on the route, and that they also have a starting device that is made like a spinner. The device, described as a "dog like starter crank" is backed up and spins the prop, the power being transmitted from the truck motor.

Colonel Harvey states the Russians have a new plane, known as the "EL". It is a single-engine liquid-cooled plane, and the Russians speak of it as a "dive bomber". This plane carries about three 100-lb. bombs, and it is armed with a cannon, (about 37 mm.), and four 50 caliber machine guns. An outstanding feature of this plane is the fact that it is covered with armor plating from the propeller to back behind the cockpit. The Russians claim that it is of 3/4" steel plating and that the entire fuselage and wing stubs are protected. This plane, which is about the size of our old A-17, is, according to the Russians, primarily used in offensive action against tanks and they allegedly have attained wonderful success with it.

Colonel Harvey states that he did not see any women mechanics, but that women were employed in great numbers in weather, radio, and on all duties around camps. No soldier is ever put on K.P. duty in Russia.

JOINT OPERATIONS - LOGISTICS

Colonel Harvey states that if any operations are ever contemplated in Siberia, (even in the vicinity of the Trans-Siberian railroad,) our forces will have to start from absolute scratch.*

*Entire ground units, air bases, communications and meteorological personnel -

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SUMMARY OF AN INTERVIEW
With
COLONEL ALVA HARVEY, A. C.,
Chief of Mission to survey Ferry Route,
Alaska to Moscow

THE ROUTE

Colonel Harvey and his party were met in Alaska by Russian pilots who were to accompany him on the projected ferry route to Moscow. From Nome, they proceeded to Velkal, Seimchan, Oimekon, Yakutsk, Kirensk, and Krasnoyarsk.

From Krasnoyarsk on to Moscow, they proceeded over the regular Vladivostok - Moscow route, airports being located at such large centers of population as Novosibirsk, Omsk, Sverdlosk, and Kazan. The initial part of the route, (i.e. to Krasnoyarsk), according to Colonel Harvey, consists of, with the exception of Yakutsk which has a 1,600 meter runway, recently completed airports of the simplest kind measuring 1,000 meters by 100 meters which is taken as a standard. Trees were cut and stumps were pulled, and the holes filled in. These fields, however, are invariably well located in valleys and all appear to offer good possibilities for future development.

No modern servicing equipment of any kind was visible at any of the airports, with the exception of several old gas trucks. The longest hop in this initial stage was 800 miles. However, Colonel Harvey states that weather forced his party down about 200 kilometers west of Seimchan and they landed at a field called Verkne Kilymsk (?). It appears that the Russians had not told him about this airport, which would seem to indicate that they have many more fields on this route than was indicated to Colonel Harvey's party. From Krasnoyarsk to Moscow all of the fields were very modern, with hard-surfaced runways. On several of these latter fields Colonel Harvey saw, from a distance, twenty or thirty training planes of the two-place type and several flights of combat planes.

He was told that planes are being manufactured in many places in the Zone of the Interior, but specifically knew only that there was a large factory at Kazan and Novosibirsk. All of the rolling stock on the railroads, proceeding east, was empty while trains proceeding to the western front were invariably loaded to capacity.

COMMUNICATIONS

Radio: At all stations the Russian pilots used homing compasses and obtained DF positions when they wanted them. They seemed to have a world of confidence in weather reports and did not hesitate to take off if the forecast was reported good or if the destination was open. It appears that all stations have direction finding equipment.

SUPPLIES

According to Colonel Harvey, it was absolutely impossible to ascertain from the Russians on the route, the extent and nature of supplies at various landing fields. When the question was asked as to gasoline in storage, the answer was

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everything, will have to be brought in and all facilities (sanitary etc.,) will have to be provided. According to Colonel Harvey, there is no running water at any staging point east of Omsk, and all towns east of Krasnoyarsk, with the exception of Yakutsk, are small log-cabin type of village so common to Siberia.

Other than the limited facilities of the RR. and the 2½ months of the year in which it is possible to ship up-stream from the Arctic, air transport remains the only means of supplying landing fields or bases in this entire area.

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WAR DEPARTMENT
HEADQUARTERS OF THE ARMY AIR FORCES
WASHINGTON, D. C.

OFFICIAL BUSINESS

PRINTED MATTER

145.81-17A
Jul-Aug 1942
TO BE RETURNED TO THE ARCHIVES OF THE AAF HISTORICAL OFFICE

MICROFILMED

COLONEL ALVA L. HARVEY

Part of Bradley Report
Diary
Messages (Incoming - Out. going)

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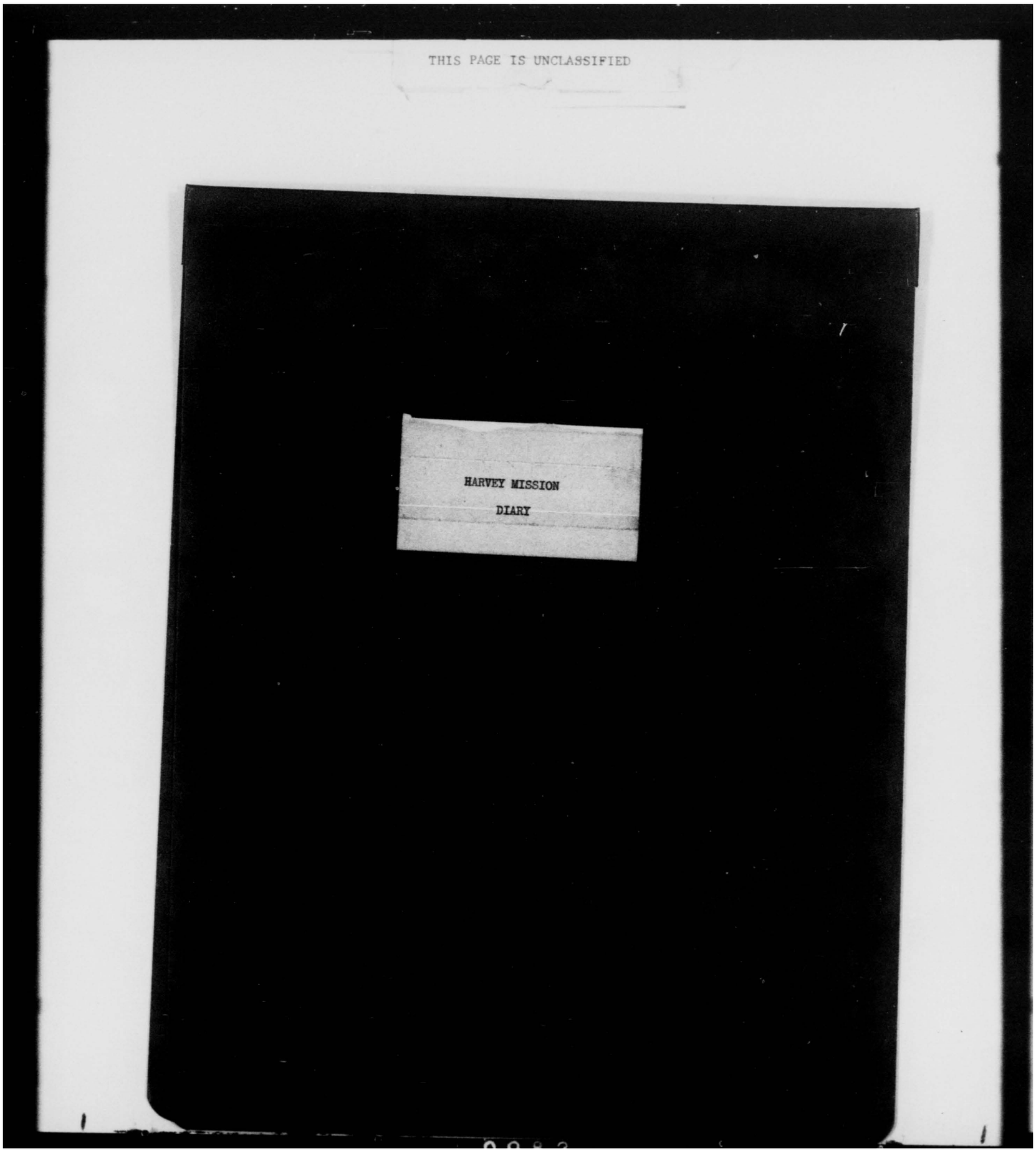

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WAR DEPARTMENT
WASHINGTON, D. C.

HARVEY MISSION

DIARY

MEMBERS:

Col. A.L. Harvey	0-10574	AC
Col. W.S. Jensen	0-16589	AC
Lt. Col. R.A. Logan	0-1699152	AUS
Lt. Col. J.F. Thompson Jr.	0-18717	AC
Lt. Col. G. Kraigher	0-911837	AC
Maj. P.J. Prossen	0-22803	AC
Capt. B.Q. Van Cott	0-274972	AC
Capt. C.E. Welchner	0-313604	AC
Capt. N. Kuzmak	0-902545	AC
1st. Lt. P.J. Boselli	0-377349	AC
1st. Lt. W.S. Page	0-475727	SC
M/Sgt. L.L. Fiebrich	R-[illegible]8545	AC
T/Sgt. F.E. Bogart	6897762	AC
Sgt. J.J. Benkovic	6895592	AC

July 30, 1942

The mission was scheduled to leave from Bolling Field on this date but due to a faulty brake was delayed one day.

July 31, 1942

Take off from Bolling Field at 11:14 GMT. Arrived Billings, Montana at 21:30 GMT.

August 1, 1942

Departed Billings 14:10 GMT and arrived Edmonton, Alberta, Canada at 17:30 GMT.

August 2, 1942

Departed Edmonton at 1235 GMT and arrived Fairbanks, Alaska at 20:06 GMT. Upon arrival Colonel Harvey was directed by a message from General Buckner to proceed immediaty to Anchorage, Alaska, for a conference. Departed Fairbanks at 21:25. Arrived Anchorage 22:55.

FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

August 5, 1942

Departed Anchorage at 18:50. Arrived Fairbanks at 20:25. Awaiting orders.

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WAR DEPARTMENT
WASHINGTON, D.C.

August 9, 1942

Col. Harvey, Maj. Rex Smith, Capt. Van Cott, and Lt. Boselli departed for Anchorage at 23:05 GMT. Arrived Anchorage 24:30. Departed Anch. at 1:20 and arrived Ladd at 2:50 GMT.

August 10, 1942

Col. Kraigher reported to Col. Harvey for duty with the Mission.

August 12, 1942

Major Prossen, Col. Kraigher, Col, Jensen, Capt. Welchner and Lt. Page departed for Nome in a C-40 airplane on a familiarization mission. Arrived Nome, Alaska at 11:45 AWT. Departed Nome at 3:30 AWT. Arrived Galena 6:30 AWT. Departed Galena at 7:50, arrived Ladd 10:00 AWT.

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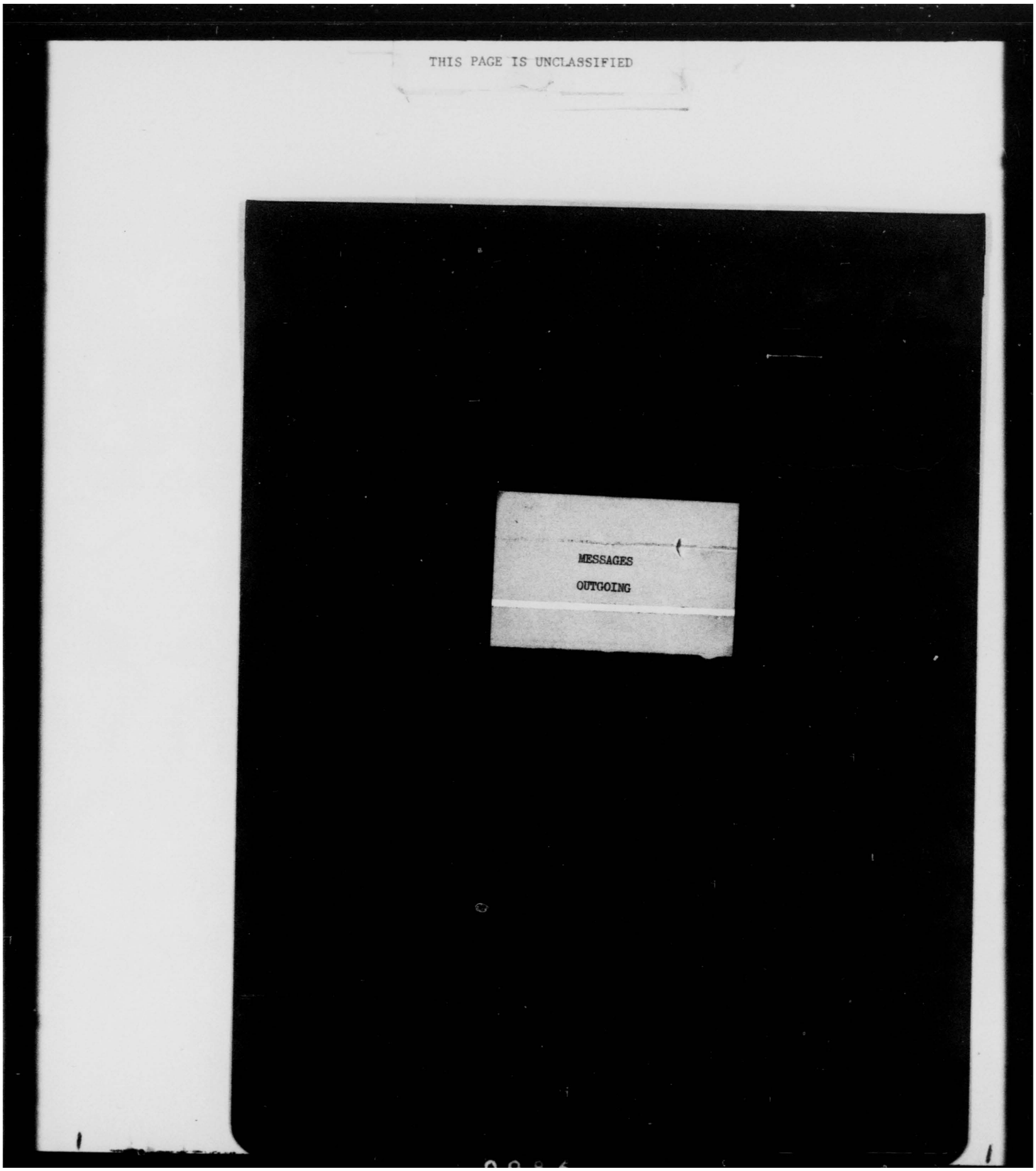

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JOURNAL Harvey Mission

UNIT 1

PERIOD.

Date	No.	In	Out	Time	Message	Action Taken
7-31-42	1		✓	MWT 1124	To Hq. Arrived Billings	
7-31-42	2		✓	MWT 1124	CAA - Harvey arrived	
7-31-42	3		✓	MWT 1130	Harvey to C.G. 4 Tr. Com. Calgary, Alberta	Flight over Canada
8-2-42	4		✓		To C.G. A.A.F. - Arr. All hands	
8-4-42	5		✓		" " Arr. Lead	
8-4-42	6		✓		To C.G. AAF Recom. Region received	
8-4-42	7		✓		To Elmendorf - Arrival notice - Lead	
8-4-42	8		✓		Nome - Arrival Lead	
8-4-42	9		✓		To C.G. AAF - No weather Conditions received yesterday	
8-4-42	10		✓	6 PM	To Gen. Bradley - Arrival of Russian Planes	
8-4-42	11		✓		C.G. AAF Arrival Russian Planes	
~~8-4-42~~	~~12~~	~~✓~~	~~✓~~		~~CO - Elmendorf - 60 miles flight time 1 hr 20 Completed~~	~~1 hr 20 min~~
8-5-42	13		✓	3P	CG - Plane for Def	
	14		✓	5P	Bradley	
8-6-42	15		✓		To AAF	
	16		✓		Bradley - [illegible]	
8-17-42	17		✓		[illegible]	
8-18-42	18		✓		[illegible]	
8-19	19		✓		[illegible]	
8-19	20		✓		Daly & Bradley	
8-20	21		✓		Daly & Bradley	
8-21	22		✓		" "	
8-22	23		✓		" " "	
8-23	24		✓		" " "	
8-24	25		✓		Bradley for Washington	

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JOURNAL _____

UNIT _____

PERIOD. _____

Date	No.	In	Out	Time	Message	Action Taken
6-25	96				Bombing - please	
6-25	97				Inf to Bentley	
6-26	98				" " Arnold	
6-27	99				Daily low Weather	
6-27	30				" " Yakutsk	
6-27	31				" " Krasnoyarsk	
6-27	32				" " Omsk	

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SAFETY FILM KODAK

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General Bedell
American Embassy
Moscow

RON OMSK DEPART FOR CENTRAL
AIRPORT MOSCOW AUG THIRTY FIRST

Henry

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General Bradley

American Embassy

Moscow

RON KRASNOYARSK

DEPART ~~AUG THIRTY~~ FOR OMSK

AUG THIRTY

14 months ext 9.15 hrd Aug 29

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General Bradley en route Moscow

FOR YAKUTSK STOP

DEPART KEREMSK AUG TWENTY

NINETH STOP OFFICIALS CORDIAL

HARVEY

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1725
10
07 25

To Jim Bradley.
moscow

Entire Party arrived Semchan Zero
Seven two Zulu Z 1700 Aug twenty seven Depart for Kirensk
via Yakutsk Aug. Twenty eight Weather
Permitting signed Harvey.

30 cents out 0800Z Aug 27

29

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General Bradley American Embassy
passw

Defecting Nome for Kemelon

Henry

11 Nov. next Aug 26

Commanding General
Army Air Forces
Wash

Henry and party departed for Berchtesgaden

MAUPIN

27 + 28

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STANDARD FORM No. 14A
APPROVED BY THE PRESIDENT
MARCH 10, 1926

TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

FROM: WAR DEPARTMENT

BUREAU

General Bradley
American Embassy
Moscow

Good communications established with Anadyr stop Will take off for Semchan with first favorable weather comma probably Aug twenty sixth stop Notify General Ostahov of above

Harvey

36 words sent 1600 A/T

22

3—9133

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TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

FROM: WAR DEPARTMENT

BUREAU

General Bradley
American Embassy
Moscow

Relay to General Ostahov Moscow quote second day no communication with Anadyr stop Anadyr requests contact on four three eight zero kilocycles which Nome does not have stop request you advise Anadyr to listen for Nome on four zero nine zero kilocycles in addition to other frequencies and also send hourly weather reports in blind signed Ostapov unquote still delayed Nome by weather.

Harvey

70 words sent 1200 AWT Aug 24

Urgent

2

3—9133

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STANDARD FORM No. 14A
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MARCH 10, 1926

TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

FROM: WAR DEPARTMENT

BUREAU

General Bradley
American Embassy
Moscow

Delayed at Nome by Weather

Harvey

words, sent 1800AWT, Aug 23.

24

3—9133

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STANDARD FORM No. 14A
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TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

FROM: WAR DEPARTMENT

BUREAU

General Bradley
American Embassy
Moscow

Delayed Nome by weather.

Harvey

// words, sent /7[illegible]AWT, Aug 22

23

3—9133

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STANDARD FORM No. 14A
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TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

FROM: WAR DEPARTMENT

BUREAU

General Bradley
American Embassy
Moscow

Arrived Nome Aug twenty first stop waiting favorable weather.

Harvey

17 Words, sent 1915 AWT Aug 21.

22

3—9183

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STANDARD FORM NO. 14A
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TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

FROM: WAR DEPARTMENT

BUREAU

General Bradley

American Embassy

Moscow

Departed For Nome one nine four zero z forced to return to Fairbanks account of weather stop Remaining over night request you notify General MXXVX Ostahow.

Harvey

31 words. Sent 1740 AWT

(21)

3—9133

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STANDARD FORM No. 14A
APPROVED BY THE PRESIDENT
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TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

FROM: WAR DEPARTMENT

BUREAU .....

General Bradley
American Embassy
Moscow.

Delayed Fairbanks by weather expect depart for Nome Aug. twenty.

Harvey

16 words.
Sent 2006 AWT Aug 19.

3—9138

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STANDARD FORM No. 14A
APPROVED BY THE PRESIDENT
MARCH 10, 1926

TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

FROM: WAR DEPARTMENT

BUREAU

August 19 1942

COMMANDING GENERAL
AAF WASH DC

FOLLOWING NAMED OFFICERS CONSTITUTE SURVEY PARTY COL HARVEY, JOHNSON, KNAICHER, THOMPSON, CROSSEN, PAGE, KUZNACK, CONFLICT DEPART FAIRBANKS FOR NOME TODAY IN SOVIET PLANES STOP CAPTAIN VAN GOTT TO B DASH TWENTY FOUR DEPARTED FAIRBANKS FOR WASHINGTON ONE EIGHT ONE FIVE Z AUGUST NINETEEN SIGNED HARVEY

PART TO LADDFIELD

SECRET

U. S. GOVERNMENT PRINTING OFFICE 3—9133

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STANDARD FORM No. 14A
APPROVED BY THE PRESIDENT
MARCH 10, 1926

TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

FROM WAR DEPARTMENT

BUREAU

Aug 18 1942

GENERAL BRADLEY
FOSTON RUSSIA

PARTY ORGANIZED AS FOLLOWS HARVEY COMMANDING JENSEN MEDICAL KNAICHER OPERATI'S
THOMSON WEATHER PROSSER SUPPLY PAGE COMMUNICATIONS AND INTERPRETOR STOP
ALL PREPARATIONS FOR DEPARTURE COMPLETE BUT TEMPORARILY DELAYED ACCOUNT WEATHER
ATTITUDE OF RUSSIAN PARTY EXCELLENT AND EXPECT THOROUGH COOPERATION AS THEY
HAVE DECLARED BOTH PLANES AND PERSONNEL TO BE AT MY DISPOSAL STOP WE HAVE
SYSTEM TWO ZERO FIVE AND WILL USE HEREAFTER STOP WILL NOTIFY YOU DEPARTURE TIME
CMA WILL CONTACT YOU DAILY AND TAKE TRIP AS RAPIDLY AS POSSIBLE CONSISTENT WITH
DEMANDS OF MISSION END HARVEY

HART CO LADDFIELD

SECRET

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Ladd Field
August 17, 1942

SUBJECT: Preliminary report on survey trip.

TO : Director of Weather, AAF, Washington, D.C.

1. Still waiting for final clearance. The Russian party arrived last Friday, Aug. 14. We are all set, but they have to get the final word yet. Hate the delay, but the situation looks very promising. They say that once we leave, Harvey is boss. Their instructions are to take him anywhere he wants to go in Siberia, and to show us anything we want to see. We are going in their planes, since our B-24 is too heavy for some of the fields we want to go to. Anyway, it looks like we will have every opportunity to do the job we want to do.

2. We don't have any kind of definite plans yet, and will no doubt get further instructions when we get to Moscow. No telling what will happen in the meantime. However, it seems to me that the matter of coordination between diffdrent areas is highly important. So if practicable, I might come back thru China and India. I don't know any reason why that cannot be arranged, and it might not cause much delay either. So, unless I get other instructions, or figure I should get back to Washington as soon as possible, I will probably try to extend my tour. If you are in favor, which I fe l sure you will be, I suggest you get a request to Gen. Bradley that I be permitted to come the other way. My present orders might be construed as not covering such a junket.

3. About the business here, Spencer was in night before last, so we had a good talk. He makes me believe that the need for straightening out the whole business here is even more urgent than indicated in my report of a few days ago. He is quite disgusted, and says Kennedy is more so. The big trouble seems to be that the Transport people seem to want a civilian show that the air lines can take over after the war. They don't want the army now, because that would mean disruption when the army is pulled out. However, they are talking only of transport, and the service, both weather and communication, that they deem necessary for transport operations. They seem to want to rely on CAA and DOT, the Canadian outfit. Experience shows that neither can deliver the goods. Also, the pilots doing the tactical work now say the weather they are getting is not good enough. In short, unless strong action it taken, the present inadaquate service will get worse, whereas it should be greatly improved. Some psople don't seem to realize that the same weather service must work both transport a d tactical, and anything else that comes along. Spencer expects to be in Washington in a couple of weeks, and I suggested that both he and Kennedy give you the whole story as soon as they can. I also think it would be a good idea if someone could check the adaquacy of the present and contemplated service for tactical operations. Such a check should furnish whatever lever might be necessary to make it an army show. I know that we cannot train men or get equipment over night, but we certainly should get the best use we can out of what we have.

4. Have not been able to get anything from the Russians yet that is worth reporting, except that the first stop out of Nome will be Semchan, about 1500 miles. They say two fields in between should be ready for use in a month. Also, it appears that there is no 100 octane gas available

17

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in Siberia. That does not sound encouraging for a heavy transport route. Incidentally, five of the officers--the transport crew, were out on a mission one night, and left for here the next morning. They seem to be tolerably happy to be on a vacation for a while. There are all good fellows too, but have absolutely no compunctions about either they or us spending American money on them.

5. Enclosed is a note I wrote up on weather business in general.

J. P. Thompson
Lt. Col., AC.

6. Nearly forgot. The Siberian stations are not coming in with any reliability here due to difficulty in reception. It is highly important to get the reports if we are to extend operations to the west. I believe the situation will be greatly improved if and when the Russians transmit from Anadyr. However, if possible permission should be secured to relay the reports on this side, either in the original or other code. There are times when reception at any one place is practically impossible. Transmission from two Siberian stations would help. I will do what I can on this from the other end, but you may be able to do something in the meantime.

JPT

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MARCH 10, 1926

TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

FROM WAR DEPARTMENT

BUREAU

AUG 16 1942

LF WD

LADDFIELD FAIRBANKS ALASKA

ACS
NOMG ALS

170140 Z RELAY TO ANADYR QUOTE OBA FERBANSKE UNQUOTE READ

ONE SIX ONE FOUR ZERO ZERO Z

HART CO LADDFIELD

(15)

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STANDARD FORM No. 14A
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TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

FROM WAR DEPARTMENT

BUREAU

Ladd Field, Alaska Aug 16, 1942

General Bradley

American Embassy

Moscow (U.S.S.R.)

DELIVER TO GENERAL ASTAHOVU QUOTE EKIPAJ ZAPIATAIA MATCHAST VILETU GOTOVI UNQUOTE

SIGNED OSIPOV

HARVEY

16

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Ptd
Москва Асбахову
Экипажи этим MATCHAST самолу готовы
Осипов

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TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

FROM: WAR DEPARTMENT

BUREAU .....

AUGUST 15, 1942

_____ LF _____ WD _____

LADD FIELD FAIRBANKS, ALS.

COMMANDING GENERAL
A.A.F.
WASHINGTON DC

_____REPORTS OBTAINED FROM RUSSIAN PARTY ON CONDITIONS OF LANDING FIELDS IN SIBERIA ~~ARE~~ ARE UNFAVORABLE FOR OPERATION OF B DASH TWENTY FOUR AIRPLANE ON MY PARTICULAR MISSION STOP I WILL LEAVE FOR MOSCOW WITH PARTY OF SIX ABOARD RUSSIAN AIRPLANE UNLESS OTHERWISE ORDERED STOP DATE OF DEPARTURE DEPENDS ON RUSSIAN COMMANDER STOP WILL ADVISE YOU DATE OF DEPARTURE STOP ~~PLEASE~~ PLEASE NOTIFY GENERAL BRADLEY ~~AND~~ SGD HARVEY

CAD

HARVEY

Gen Bradley

SECRET

cc 13 CG
14 Bradley

SECRET

3—9133

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STANDARD FORM No. 14A
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TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

FROM: WAR DEPARTMENT

BUREAU

Aug 14 1942

COMGANDING GENERAL AAF
WASH DC

RUSSIAN PARTY ARRIVED FAIRBANKS WITH ONE B DASH TWENTY FIVE AND ONE DOUGLAS TRANSPORT AIRPLANE X THEY HAVE FACILITIES FOR TRANSPORTING PARTY OF SEVEN IN EVENT AMERICAN PLANE IS NOT AUTHORIZED X AM AWAITING ORDERS AT FAIRBANKS PERIOD NOTIFY GEN BRADLY STOP HARVEY

HART CO LADDFIELD

SECRET

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TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

FROM: WAR DEPARTMENT

BUREAU

TO: General Bradley care American Embassy moscow Russia.

(10) Russian Party arrived Fairbanks with one B Lash Twenty five and one Douglas Transport airplane STOP They have facilities for transporting Party of seven in event ~~[illegible]~~ american plane is not authorized STOP We are awaiting orders at Fairbanks

Harvey

Encyphered by Lt Col Thompson and Lt Page 8/14/42 at 6 PM.

Secret (joint Russian-American)

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August 10, 1942

SECRET RADIOGRAM

TO: Commanding General AAF, Washington, D.C.

ATTENTION: Plans Division. Copy to CG Air Transport Command.

Study of conditions in the Alaska-Canadian Area to facilitate Ferry Route reveals urgent need for immediate improvement in Weather and Communications facilities all along the route. In addition ramp Servicing Billeting and Parking accomodations need considerable enlarging at all points. Following are recommendations which should be given immediate attention:

Consolidate CAA and AACS communications facilities and personnel under AACS contr l.

Give high priority to requisitions for SIGNAL PROPERTY in this area.

Enlarge Servicing Parking and Billeting accomodations at all points especially at Edmonton, Whitehorse, Fairbanks, Nome.

Increase supplies of Fuel and Oils in proportion to the number of Airplanes contemplated moved thru the Area.

(1)

Harvey

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TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

FROM: WAR DEPARTMENT

BUREAU

1W7X 5WD Operational Pltty
Paddfield Als, 2050 GCt Aug 5

Operations Officer
Naval Als.

151874/2018/005/ Signed BAKER
CARR Co Paddfield

(8)

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STANDARD FORM No. 14A
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TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

FROM: WAR DEPARTMENT

BUREAU

To Eisendorf

23 1674/2016/005//

1

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COPY COPY COPY

To; Commanding General Army Air Forces. August 5, 1942

Attention Plans Division.

Strongly recommend Colonel Kraigher be removed from assignment to duty with the survey mission due to present overload on aircraft.

Harvey

6

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Form 125D

Signal Corps, United States Army

Telegram

GPO 3—10505

Received at 8. 4 1942

GCT 8.45

Alaskan Time 11:45

TO: CHIEF OF AIR CORPS

WASHINGTON, D.C.

B DASH TWENTY FOUR D ONE ONE EIGHT SEVEN FOUR PILOT HARVEY ARRIVED X LADD FIELD

TWENTY EIGHTEEN GCT END SIGNED BAKER

CARR CO LADDFIELD

(h)

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COPY COPY COPY

To: Commanding General, Army Air Forces August 2, 1942

Arrived Anchorage today. Have completed conference with General Bruckner. Have received no information from General Bradley regarding arrival Russian party. Remaining Anchorage awaiting orders.

Harvey

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CIVIL AERONAUTICS AUTHORITY
Form 63
GPO 16—7601

DISPATCH

Commanding General
Fourth Training Command
First St. West,
Calgary, Alberta.

One bomber Consolidated B-24D No.41-11874 A L Harvey Col. with 12 will depart 1 Aug 0600M Billings to Edmonton direct arrive about 1130M one hour fifteen minutes over canadian territory stop transmit on 4495 and 6210 stop code or identifications not available stop remaining over night at Billings

Harvey

3

7-31-42
Billings

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A 345306

COMMAND GENERAL

ARMY AIR FORCE

WASH. DC

ATTENTION PLANS SECTION RON XD

HARVEY

2

B. Hill Jr
7-31-

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BI A 345305

ABVZ CAA ARMY 41-11874 PILOT HARVEY ARVD

XD 1124MWT

DODGE XD

(1) B. Hipp 7-31-42

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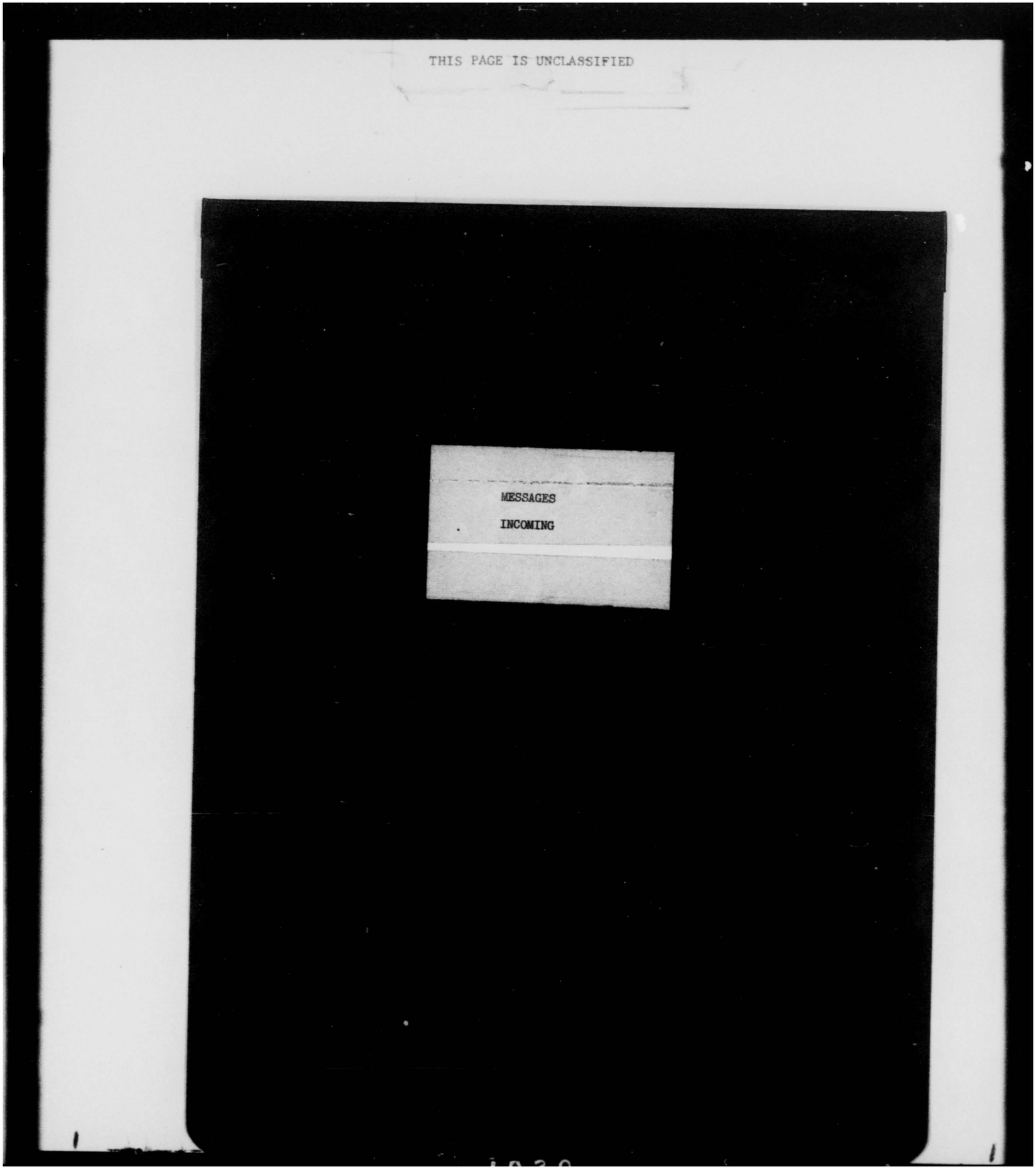

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JOURNAL 1

UNIT Harvey Mission

PERIOD.

Date	No.	In	Out	Time	Message	Action Taken
5-4-45	1	✓		1146	Fr. Arnold - Russian Fairbanks until further orders	
5-4-45	2	✓		1723	Fr Marshall - Russia Swiet plan re Supply	
5-5-45	3	✓			Gray Saint - Service within & Packard	
5-5-45	4	✓			Fr Arnold re housing & facilities for Russians at Fairbanks	
5-5-45	5	✓			Comm Heal Provision of Communications Operators	
5-13-45	6	✓			Bossetti Promotion	
5-14-45	7	✓				
5-14-45	8	✓			From Gault - Missions passing thru Fairbanks To [illegible]	
5-14-45	9	✓			Fr Arnold re Communications equipment fuel & housing facilities erected to completion	
5-14-45	10	✓			Fr Dewitt To CG-FE Relocation re weather & radio facilities	
5-15-45	10	✓			Marshall re flights	
5-17-45	11	✓			Arnold & Russian Mission	
5-17	12	✓			Arnold - party	
5-17	13				marshall - Gallant & party	
5-18	14				Bradley - instruction	
5-18	15				Arnold - evacuation	
5-21	16	✓	(3pm)		Arnold for pilots	
5-21	17				Ltr from Bradley	

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Prep with you twenty or thirty maps or
routes Rome to Fairbanks RMD
Direct your Soviet field request instructions
at first Siberian stop for clear passage
updated to soviet authorities prepare to permit
Soviet pilot study route in advance PD
your message dtg 4 mar 42

(Top most garbled)

#17

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STANDARD FORM No. 14A
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TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

FROM: WAR DEPARTMENT

BUREAU .....

AUGUST 21, 1942

14 FN ED 129 WD PRTY CENVD

WAR WASH DC 0103 Z AUG 21, 1942

THIS IS FOR COL HARVEY FROM AFA CG PERIOD DELIVER TO COMMANDING OFFICERS OF TWO SOVIET PLANES IN FAIRBANKS PD THESE INSTRUCTIONS RECEIVED FOR YOU FROM MOSCOW SIGNED SCMENOI BY MAICENKLY AEV PD TAKE OFF FROM FAIRBANKS FOR RETURN FLIGHT ALONG SAME ROUTE IF FAVORABLE WEATHER CONDITIONS PERMIT PD ON RETURN FLIGHT FOLLOW ALL INSTRUCTIONS PREVIOUSLY RECEIVED FROM ME PD AT FAIRBANKS MONOKOV IS TO TAKE FIVE MEN FROM BRADLEYS SURVEY PARTY ABOARD HIS PLANE AND OSSIPOVISTO TAKE THREE MEN FROM BRADLEYS SURVEY PARTY ABOARD HIS PLANE PD SIMULTANEOUSLY BOTH PLANES ARE TO PROCEED TO NOME FROM FAIRBANKS AND LAND IN NOME PD INSTRUCTIONS AS TO THE POSSIBILITY OF LANDING AT WELKAL AIR DROME SHOULD END FIRST SECTION OF THREE PART MESSAGE MORE TO FOLLOW

ARNOLD

16

SECRET

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9-9138

1923

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STANDARD FORM No. 14A
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TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

FROM: WAR DEPARTMENT

BUREAU .....

AUGUST 21, 1942

33 FN ED 123 WD CENVD

WASHN DC 0104 Z AUG 21, 1942

BE

WE RECEIVED BY MONOKOV IN NOME THROUGH AN ADYR RADIO STATION PERIOD THE PHRASE QUOTE LANDING POSSIBLE UNQUOTE WILL BE GIVEN FOR PERMISSION TO LAND PERIOD INSTRUCTIONS WILL GIVEN BY PHRASE QUOTE LANDING NOT UNQUOTE IF LANDING IS NOT POSSIBLE PERIOD OSSIPOV AND MONOKOV WILL CONTINUE THEIR FLIGHT FROM NOME TO SEIM CHANE AGH CARRYING THEM IN FROM SURVEY PARTY IF PERMISSION IS NOT GIVEN TO LAND AT WELKAL AIRDRORNE PERIOD IN THE EVENT PERMISSION TO LAND AT WELKAL IS GIVEN THE ENTIRE SURVEY PARTY OF EIGHT MEN IS TO BE TAKEN ABOARD MONOKOVS PLANE AND HE WILL PROCEED TO WELKAL AIR DRORNE TO DETERMINE THE TIME THE AIR DROME WILL BE READY FOR THE OPE ATION OF IT PERIOD THE SECOND SECTION OF THREE PART MESSAGE MORE TO FOLLOW

ARNOLD

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S E C R E T

38 FN RD 107 WD CENWVC WAR WASH DC 0104Z AUG 21 1942

CO LF

MONOKOV IS TO CONTINUE HIS FLIGHT TO SEIMCHAN AFTER INSPECTING WELKAL PERIOD OSSIPOV IN THIS CASE IS TO CONTINUE HIS FLIGHT TO SEIMCHAN WITHOUT ANY MEN OF THE ABOVE MENTIONED SURVEY PARTY AND AT SEIMCHAN HE IS TO AWAIT MONOKOV ARRIVAL THERE PERIOD YOU SHOULD RADIO IMMEDIATELY TO MOSCOW THROUGH ANADYR INFORMATION OF YOUR TAKE OFF FROM FAIRBANKS AND ALASKA PERIOD OSYIPOV AND MONOKOV SHOULD TAKE OFF SIMULTANESUSLY FROM AIR DROMES AS MEMBERS OF SURVEY PARTY ABOARD BOTH PLANES WILL PERFORM THEIR WORK TOGETHER AT ALL AIR CROMES ALONG THE ROUTE END OF THREE SECTION MESSAGE COMBINE WITH SECTIONS ONE AND TWO THAT IS ALL

ARNOLD

S E C R E T

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STANDARD FORM No. 14A
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TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

FROM: WAR DEPARTMENT

BUREAU

AUGUST 18, 1942

58 FN TO 152 WD CENWVD

WASH DC 1417 Z AUG 1942

COMMUNICATE WITH ME IN SYSTEM TWO NAUGHT FIVE ONLY CMA AS NUMBER TWO ZERO FOUR IS RESERVED FOR USE BY SOVIETS AND AT CHI AT FAIRBANKS AND NOME TO EXCHANGE INFORMATION RELATIVE TO FERRY OPERATIONS STOP YOUR MSG AUGUST ONE FOUR RECEIVED PAREN THIS MSG FOR COLONEL HARVEY FROM PARADISE PAREN AS SUMING YOU ARE CONTENT WITH MAKEUP OF YOUR PARTY START AT ONCE IN RUSSIAN AIRPLANES AND LET ME KNOW THE NAMES AND DUTIES OF EACH PERSON STOP ADVICE ME DAILY AS TO YOUR LOCATION CMA HOW LONG YOU EXPECT TO STAY CMA YOUR NEXT POINT OF ARRIVAL COMMA THE ATITUDE OF SOVIET OFFICIALS ET CETERA PD YOU WILL BRING WITH YOU TWO NAUGHT OR THREE ZERO MAPS DEPICTING AERIAL ROUTES BETWEEN NOME TO FAIRBANKS AND FAIRBANKS AND HAVE YOUR SOVIET PILOT AAH FOR INSTRUCTIONS AT FIRST STOP IN SIBERIA TO INSURE THEIR PROMPT DELIVERY TO THE SOVIET AUTHORITIES IN MOSCOW SO THE RUSSIAN PILOTS MAY STUDY ROUTE IN A STATE

FRENCH

300

2-9133

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STANDARD FORM No. 14A
APPROVED BY THE PRESIDENT
MARCH 10, 1926

TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

FROM: WAR DEPARTMENT

BUREAU

SEVENTE - SOVI

3—9133

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MARCH 10, 1926

TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

FROM: WAR DEPARTMENT

BUREAU

AUG 18 1942

Wash DC

CO IF ESTABLISH DIRECT CONTACT WITH BRADLEY PARTY FOR HARVEY FR M AFACT PAREN NOTIFY HIM AND WAR DEPT HOUR AND DATE OF DEPARTURE AND NAMES OF PARTY WITH YOU IN SOVIET PLANES STOP YOUR B DASH TWENTY FOUR TO BE RETURNED TO HOME STATION STOP AFTER YOUR DEPARTURE FROM ALASKA ALL WD CONTACTS WILL BE WITH BRADLEY COMA WITH YOU NONE

MARSHALL

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TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

FROM: WAR DEPARTMENT

BUREAU

AUG 18 1942

Wash DC

CO LF EXPLORATORY PARTY IS LIMITED TO EIGHT AND COLONEL HARVEY COMMANDING OFFICER HAS BEEN FURNISHED WITH LIST OF OFFICERS APPROVED STOP ATC FOUR THREE EIGHT THREE NO ADDITIONALS TO PARTY WILL BE MADE

ARNOLD

SECRET

12

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STANDARD FORM No. 14a
APPROVED BY THE PRESIDENT
MARCH 10, 1926

TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

FROM: WAR DEPARTMENT

BUREAU

AUGUST 17 1942

56 RA 143 WD DENNXE

HQ AAC FTRICHARDSON 20442

1693852 FOR COL HARVEY STOP FOLLOWING IS ARMYHARSE OF RAD RECEIVED AUGUST FIFTEEN FROM GEN BRADLEY STOP LEAVING SYRACUSE AUG THIRTEEN FOR NOME SOVIET DC DASH KIRSE ARRIVING NOME FOURTEEN OR FIFTEEN STOP ON BOTTOM BOTH WINGS AND BOTH SIDES FUSELAGE IS RED STAR STOP ON RIGHT SIDE FUSILAGE NUMBER THREE FOUR EIGHT NINE NEAR TAIL STOP CALL LETTERS RPGVB WAVE LENGTH SIX TWO POINT FIVE SIX METERS WITH ALTOP MZTE EIGHT SEVEN POINT NINE EIGHT BOTH CONTINUOUS ENTIRE FLIGHT STOP CREW PILOT MJ NKLOVCL PILOT ADOROV NAVIGATOR KOVUZOV AND RADIO MAN YCTOROV MECHANIC TLENE STOP FYY WE WILL ARRIVE NOME AND FAIRBANKS AFTER B DASH TWO FIVE PRESCRIBED RADIO COMMA NICKTION AND APPROACH PROCEDURES UNDERSTOOD STOP SAME WEATHER CODES TO BE USED FOR BOTH PLANES CREWS HAVE RECEIVED NISAS AND UNDERSTAND BOTH PLANES ARRIVED ABOUT AUG THIRTEEN BUT THIS IS PASSED TO YOU FOR YOUR INFO

GAULT AG AC

2220Z

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OFFICIAL BUSINESS—GOVERNMENT RATES

FROM: WAR DEPARTMENT

BUREAU

Survey party authorized eight members as follows: Harvey, Jensen, Logan, Prosser, Thompson, Kraigher, Page, Welchner. If necessary leave any one OFF DROP Welchner. From Bradley for Harvey. Kraigher and Page authorized but this is unusual reversal of Soviet original policy. Re your rad seven August fourteenth you should warn them that they will be constantly watched and any statement or any action by them will without doubt be reported. (From PT not for Harvey) Names of your complete party with their duties will be sent to Bradley. Secure services radio man Dmitrov to contact Bradley over soviet ground stations in cipher 208. Survey party in Soviet B REPEAT 9-28 and DC rpt. DC- leave immediately.

Marshall

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APPROVED BY THE PRESIDENT
MARCH 10, 1926

TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

FROM: WAR DEPARTMENT

BUREAU

AUG 14 1942

59 FN 61 WD PRTY CENWD

QAR WASHN DC 142014 Z

CO
LADD FIELD

PLANS PROVIDE FOR POINTS MENTIONED UPAD FIVE FIVE STOP DIFFICULTIES EXPERIENCED OBTAINING FIRST PRIORITIES COMMUNICATIONS EQUIPMENT AS OTHER THEATRES OF OPERATIONS HAVE EQUALLY PRESSING NEEDS STOP FROM GEORGE ATC ATTN COL HARVEY STOP EXERTING PRESSURE TO COMPLETE HOUSING PARKING APRONS AND INSTALLATION AMPAL FUEL AVAILABLE BEFORE FIRST FREEZE

ARNOLD

2250 Z

9

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OFFICIAL BUSINESS—GOVERNMENT RATES

FROM WAR DEPARTMENT

BUREAU

AUG 14

ADC

FLIGHT SURVEY IN CONNECTION WITH POLAR FLIGHT SURVEY ARRANGED BY GEN ARNOLD SIX RUSSIAN AVIATOR PASS THROUGH FAIRBANKS EN ROUTE TO HOME STOP PILOT MAJOR ARB MAJOR TARASOV NAVIGATOR SAFUNOV RADIO MAN DAKTUOV MECHANIC FLIGHT PILOT ALEXOV ONE MALE UNKNOWN STOP ARMY AIR FORCES REQUEST THESE MEN BE NOT REPT NOT DELAYED GIVE FULL STOP CAPT RYAN TO BE INFORMED

GAULT

PARAPHRASE MSG SECRET

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STANDARD FORM No. 14A
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MARCH 10, 1926

TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

FROM: WAR DEPARTMENT

BUREAU

Aug 14 1942

War Wash DC

CO LF THEODORE JOHN BOSELLI MAUGHT DASH THREE SEVEN SEVEN THREE FOUR NINE YOUR SIX ZERO F R ARMY WAS PROMOTED TEMPORARILY CAPT AUS PAREN AC PAREN AUG FIVE ONE NINE FOUR TWO WITH RANK AUG FIVE PER SPECIAL ORDER TWO ZERO NINE UNDER PROVISION PUBLIC FOUR FIVE FIVE CMA SEVEN SEVENTH CONGRESS

OLIO

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Air Office, ADC

HQ ADC AUG 10 1942

R A D I O G R A M

154 AG JA 969 WD CHKWVD

A WDCAMD 4 A 0205 Z AUG 0 1942

COMMANDING GENERAL ADC

FT.RICHARDSON ALS

AU 111.PROPOSAL FOLLOWING IS BY USSR FOR EXCHANGE OF WEATHER INFORMATION FOR USE ON AIR ROUTE NOME WELKAL SHESKNOS SIMCHAN OINYAKON YAKUTAT GOLON XXXXXX WEATHER BULLETINS WILL BE ISSUED BY USSR EVERY TWO HOURS FROM TWO ZERO TWO ZERO TO ONE ZERO TWO ZERO GMT FROM STATIONS AS FOLLOWS QUOTE BERELYU SEMCHAN MARKOVO AIKLXDR WELKAL WELLIN SHESANOS KORCODEN PEREVALNAYA SC MIDT CHUK PROVIDENTIA HAIDON XX ULYAGAI PLUS FOUR OTHER STAYS XXDTXXXMJQFWJFRHFHAP WILL BE ISSUED SIX HOURS IN ADVANCE FOR ROUTE GIVING METRIC MEASUREMENTS SEMICOLON HEIGHT FORMATION AMOUNT OF CLOUDS COMMA VELOCITY DIRECTION OF WIND COMMA VISIBILITY COMMA PRECIPITATION COMMA SPECIAL CHANGES IN WEATHER STORM TYPHOON FOG ETC STOP FORECASTS TO BE GIVEN IN INTERNATIONAL AVIATION CODE STOP/PARAGRAPH TWO USER REQUESTS UNITED STATES FURNISH SAME TYPE FORECASTS FOR ROUTE IN SAME CIPHER AND CODE STOP/PARAGRAPH THREE USSR PROPOSES TO USE METHOD AND TABLE BAKER FOR ENCIPHERING OF BULLETINS AND FORECASTS WITH PRESENT RULES STOP NOTE TABLE SIX EFFECTIVE ZERO ZERO ZERO ZERO SEPT ONE SA A TABLE SEVEN EFFECTIVE ZERO ZERO ZERO ZERO OCT ONE STOP TABLE EIGHT EFFECTIVE ZERO ZERO ZERO ZERO NOV ONE STOP TABLE THREE TO BE REPEATED FROM AUG ONE STOP/PARAGRAPH FOUR TRANSMITTAL OF THESE BULLETINS AND FORECASTS FROM NOME REQUESTED BY USSR/PARAGRAPH FIVE USSR PROPOSES TO GIVE FORECASTS AND METEOROLOGICAL BULLETINS EVERY TWO HOURS FROM FOLLOWING STATIONS QUOTE FAIRBANKS NOME SAINT PAUL POINT BARROW CORDOVA YUNIVAN AKLAVIK SAINT MATHEW ISLAND SAINT LAWRENCE ISLAND LIVENWOOD FLAT DILLINGHAM ANCHORAGE UNQUOTE

(6)

SECRET

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SECRET

PARAGRAPH SIX USSR PROPOSES DIVIDING ROUTE IN FIVE DIVISIONS ASSIGNING EACH DIVISION IDENTIFYING NUMBER IN ACCORDANCE WITH A GROUP OF THE LLL CODE STOP MOSCOW TO WALKEL NUMBER ZERO ZERO ONE WALKEL TO SHEMYA ZERO ZERO TWO SHEMYA TO SHACHAN ZERO ZERO THREE SHACHAN TO OLMYAKON ZERO ZERO FOUR OLMYAKON TO YAKUTAK ZERO ZERO FIVE H STOP PARAGRAPH SEVEN REQUEST YOU IMMEDIATELY INITIATE TRANSMISSION FROM YOUR OWN RESOURCES AND AT TIMES SUGGESTED OF OBSERVATIONS AND WEATHER FORECASTS REQUIRED BY USSR USING ACS PERSONNEL FOR RECEIVING AND TRANSMISSION AND AAF PERSONNEL FOR OBSERVATION AND FORECASTING STOP REPORT TO THESE HEADQUARTERS WILL BE MADE WHEN SERVICE IS COMMENCED IN WHOLE OR IN PART STOP YOUR RECOMMENDATION REQUESTED RELATIVE FEASIBILITY ESTABLISHING ADDITIONAL OBSERVING STATION SAINT PAUL AND SAINT MATHEW USING AAF PERSONNEL STOP INCLUDED IN PLAN SHOULD BE AN ARMY INTELLIGENCE DETACHMENT FOR SAINT MATHEW SIMILAR TO DETACHMENT NOW ON ST PAUL STOP PARAGRAPH EIGHT ACTION AS FOLLOWS HAS BEEN TAKEN COLON USSR REQUESTED TO PLACE OBSERVATIONS GIVEN IN PARAGRAPH ONE ON KHABAROVSK PRESENT BROADCAST [redacted] STOP USSR REQUESTED BROADCAST FROM ANYADIR OF PROPOSED BULLETINS EVERY TWO HOURS THROUGHOUT THE TWENTY FOUR STOP APPROVAL GIVEN TO FREQUENCY AND STATION OF BROADCAST COMMA BROADCASTS STOP USSR REQUESTED XXX FOR PRESENT TO USE CITIES BAKER BUT REQUESTED SHIFT TO ONE WAY PAD CITIES WITH TWENTY FIVE STATION MILITARY DISTRIBUTION CANADA ALASKA UNITED STATES FIVE NO NECESSARY PERMITTED COMMA CIPHERS TO BE PREPARED BY USSR FOR DELIVERY TO HOME SEPT ONE AND US TO FURNISH SIMILAR PAD FOR HOME TRANSMISSION DISTRIBUTION TO BE MADE IN USSR ON SIMILAR BASIS STOP USSR REQUESTED TO BROADCAST BULLETINS EVERY TWO HOURS THROUGHOUT TWENTY FOUR STOP USSR REQUESTED CLARIFY STATEMENT OF FREQUENCY BY GIVING IN KILOCYCLES STOP USSR ADVISED THAT INVESTIGATION BEING MADE OF FEASIBILITY PROVIDING OBSERVATIONS ST PAUL ST MATHEWS ISLANDS STOP USSR ADVISED NAUKAN SUBSTITUTED FOR DILLINGHAM NOAS FOR LIVENGOOD NOGRAM FOR FLAT COMMA POINT BARROW AND AKLAVIK AVAILABLE ONLY AT SIX HOURLY INTERVALS FOR THE PRESENT STOP REFERENCE PARAGRAPH FIVE USSR ADVISED THAT UNITED STATES WILL FURNISH REQUESTED INFORMATION BUT STRONGLY RECOMMENDS TRANSMISSION ADDITIONAL STATIONS

PENDING ANYADIR BROADCAST PROPOSED

SECRET

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R A D I O G R A M

CONFIDENTIAL

PRIORITY

8-9-42

_____LF_____WD_____

LADDFIELD, FAIRBANKS, ALASKA_____

CG 11TH AF

FT RICHARDSON

_____COM STOP FOR COL KING NO INFORMATION OR INSTRUCTION RE RUSSIAN PLANE RECEIVED TO DATE BY ANY LOCAL COMMUNICATIONS AGENCY STOP SPECIAL COMMUNICATIONS CHANNEL HAS NOW BEEN PROVIDED BY AACS STATION WZY WITH FOLLOWING TRANSMITTING WAVELENGTHS IN METERS COLON CW THREE SIX POINT FIVE NINE COMMA SIX FIVE POINT TWO NINE COMMA ONE ONE THREE POINT FIVE COMMA VOICE SEVEN ONE POINT NAUGHT NINE COMMA AIRPORT CONTROL TOWER VOICE SEVEN FIVE EIGHT STOP SUGGEST CHECKING ANADYRS CALL LETTERS AS BERNE LIST IDENTIFIES SAME AS RTHU RPT RTHU NOT RHTU ALSO CHECK NOME RADIO RANGE AS GIVEN TO ANADYR IN RADIOGRAM FROM ADC TO C OF S DATED AUGUST FOURTH STOP PLEASE ADVISE ANADYR IF POSSIBLE AND NOME OF FAIRBANKS STATION CALL WZY AND ABOVE LISTED TRANSMITTING FREQUENCIES STOP ARMY WEATHER NOME INSTRUCTED TO FILE WEATHER WITH ACS FOR BLIND TRANSISSION END

NEAL

HART CO LADDFIELD

OFFICIAL

APPROVED

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S E C R E T

Air Office, ADC

HQ ADC AUG 8 1942

R A D I O G R A M

244 AG RW 256 WD PRTY CENWVD

WAR WASH DC 1712 Z AUG 8 1942

COMMANDING GENERAL ADC

FT RICHARDSON ALS

645 TRANSMIT APPUOACR PROCEDURE DETAILS FOR RUSSIAN AIRCRAFT TO GENERAL BRADLEY WITH INSTRUCTIONS FOR HIM TO PRESENT TO SOVIET GOVT SO THAT DETAILED INFORMATION CAN BE DELIVERED BY THEN TO THEIR AIRCRAFT THROUGH THEIR OWN CODE THUS INSURING MAXIMUM SECURITY PERIOD REURAD NUMBER FIVE NINE THREE AIR TRANSPORT COMMAND REQUIRES UNDER ITS OWN COMPLETE CONTROL AT FAIRBANKS IN ORDER TO ACCOMDATE AIRCRAFT TO BE FERRIED FOR RUSSIA FOLLOWING FACILITIES COMMA ONE STANDARD SIX HANGER WITH ALL FACILITIES PLUS HOUSING AND MESS FOR THREE FIVE ZERO OFFICERS AND TWO HUNDRED MEN PARAGRAPH INFORMATION IN YOUR ADC THREE ONE THREE PASSED TO RUSSIAN EMBASSY WASHINGTON AT TWO THREE ZERO ZERO OCT AUGUST SEVEN WITH REQUEST THAT RHTU STAND BY ON FREQUENCIES YOU INDICATE AT TIMES STATED PERIOD ATC FOUR ZERO FIVE THREE SIGNED ARNOLD END GEORGE ANADYR DOES NOT RPT NOT HOLD CIPHER SYSTEM SIGBTP OR ANY OTHER SYSTEM HELD BY YOUR HEADQUARTERS PERIOD LOCATION OF CAPE SPENSEN AFFIRM TWO THREE NOT RPT NOT KNOWN HERE THEREFORE USSR ADVISED NOT RPT NOT TO EXPECT REPORTS FROM THERE PERIOD WE HAVE NO RPT NO ADDRESS NOR ALTERNATE ROUTE TO CONTACT GENERAL BRADLEY EXCEPT AS KNOWN TO LT PAGE

ARNOLD

081854 Z

4

S E C R E T

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Col. Hunter

11-89

STANDARD FORM No. 14A
APPROVED BY THE PRESIDENT
MARCH 10, 1926

TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

FROM WAR DEPARTMENT

BUREAU JWH

Aug 8 1942

Hq. ADC

CO LF 072159 FOR COL HARVEY PARAPHRASED FR M WN AAF REMOVE WELCHNER IF OVERLOADED SINCE KRAIGHER ESPECIALLY FITTED WITH MANY YEARS EXPERIENCE THIS PARTICULAR WORK IN ALL PARTS OF WORLD AND KNOWLEDGE OF LANGUAGE

GAULT

(3)

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/3FP

H[illegible].,A.D.C. AUG 4 1942

R A D I O G R A M

(2)

289 AG OR 600 URGENT

WASHN D C AUG 041559 Z

COMMANDING GENERAL ADC

FT RICHARDSON ALS

URGENT 503 JOINING PART LT DOL KRATCHER COMMA REFERENCE OUR NUMBER FIVE FIVE SIX COMMA DUE FAIRBANKS ABOUR AUGUST EIGHTH PARAGRAPH USSR SENDING AIRPLANE TYPE B TWENTY FIVE COMMA RECOGNITION SIGN USSR SEVEN ONE THREE ON AND BELOW WING AND BOTH SIDES FUSELAGE COMMA STAR ON RUDDERS STOP RECOGNITION SIGNAL BY RADIO QUOTE I AM A FRIENDLY PLANE UNQUOTE PROBABLY SENT IN RUSSIAN QUOTE ID SVOI SAMOLET UNQUOTE REPEAT QUOTE IA SVOI SAMOLET UNQUOTE PERIOD PYROTECHNICS TWO GREEN ROCKETS COMMA DUE NOME FROM ANADYR BETWEEN AUGUST EIGHTH AND TENTH PERIOD THIS AIRPLANE HAS RADIO CALL SIGNAL RPUDA RPT ROGER PREP UNIT DOG AFFIRM WORKING SIX TWO POINT FIVE SIX METERS AND EIGHT SEVEN POINT NINE EIGHT PERIOD SOVIET PLANE WILL ADVISE BY RADIO TIME OF TAKEOFF FROM SEIMCHEN FOR NOME THROUGH ANADYR RADIO STATION CALL SIGNALS RHTU RPT ROGER HYPO TARE UNIT TWENTY SIX METERS PARAGRAPH WE HAVE ASSURED SOVIETS WE WILL ESTABLISH RADIO COMMUNICATION WITH ANADYR AT INTERVALS OF TWENTY TO THIRTY MINUTES EACH HOUR PERIOD ALSO THAT WEATHER REPORTS SHALL BE TRANSMITTED IN THE FOLLOWING CODE FROM THE POINTS NAMED EACH FIRST FIVE MINUTES OF EVERY

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HALF HOUR GREENWICH TIME AND IMMEDIATELY UPON REQUEST SEMICOLON
TIME COMMA HOUR COMMA MINUTE PERIOD NAME OF TRANSMITTING POINT
COMMA NOME A MKVE NINE COMMA FAIRBANKS A SIX THREE COMMA CAPE
SPENSEN A TWO THREE COMMA NULATO A EIGHT THREE COMMA TENANA A
NINE TWO PERIOD CLEAR B ONE SEVEN COMMA RAIN B THREE SIX COMMA
FOG B EIGHT SEVEN COMMA COMPLETE CLOUDINESS B NINE SEVEN COMMA
ALTITUDE OF CLOUDS IN METERS B TWO SIX COMMA CLOUDY B SIX SEVEN
PERIOD WE DEPENDING UPON YOU INSTITUTE THIS ARRANGEMENT AND ADVISE
ANADYR EXACT DETAILS OF TRANSMISSION TIME COMMA WAVELINGTHS TO
GROUND STATIONS AND ALSO PLANE SEMICOLON SOVIETS DESIRE WEATHER
TRANSMISSION TO PLANE ON NAVIGATION WAVELENGTH WHICH PRESUME YOU
CAN ARRANGE PERIOD AFTER RECEIPT CLEARANCE FROM GENERAL BRADLEY
MOSCOW WHICH YOU SHOULD REQUEST COMMA WE AUTHORIZE YOUR RADIOING
SOVIET PLANE COMMANDER GIVING RECOGINTION SIGNS FOR AIRDROMES IN
NOME GALENA AND FAIRBANKS SEMICOLON ROUTE OF FLIGHT TO APPROACH
NOME AND OR OTHER AIRPORTS NAMED COMMA AS WELL AS ANY OTHER
SECURITY MEASURES YOU DESIRE VISITING PLANE TO OBSERVE PERIOD IN
ORDER TO ASSURE COMPLETE LIAISON RADIO COMMUNICATION WITH SOVIET
GROUND STATIONS AND PLANE SUGGEST LT PAGE IF THE HARVEY SURVEY
PARTY WORK DIRECTLY WITH YOUR STAFF ON THIS MATTER PARAGRAPH WE
DESIRE ASSURE EXPEDITIOUS ARRIVAL SOVIET PLANE NOME OR FAIRBANKS
COMMA AND ARE SUGGESTING LATTER DESTINATION TO SOVIETS SINCE
FERRY DELIVERY TO RUSSIA COM WILL BE EFFECTED FAIRBANKS PARAGRAPH
WE PREFER HARVEY RPT HARVEY PLANE PROCEED IN COMPANY SOVIET PLANE
ON RETURN TO SIBERIA IN ORDER THAT ENTIRE SURVEY PARTY MAY HANDLE
THEIR SPECIALITIES IN ARCO UNDER STUDY PERIOD ADVISE HARVEY COMMENTS
THIS MESSAGE

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ORIGINAL TO CSI FOR ACTION
AG FILE
AG JOURNAL
SERIAL FILE
COPY G - 2
COPY G - 3

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/LFM

HQ. A.D.C. AUG. 4 1942

RADIOGRAM

32 AC EM 116 WD

(1)

WW EC NFT AUG 2

HEADQUARTERS ADC

FT RICHARDSON ALS

569 MATTER PERTAINING TO YOUR MISSION STILL UNDER DISCUSSION PERIOD YOU WILL BE KEPT INFORMED AFEAP FOR COLONEL ALVA HARVEY PERIOD YOU ARE AUTHORIZED TO REMAIN TEMPORARILY AT EITHER ANCHORAGE OR FAIRBANKS UNTIL YOU RECEIVE FURTHER INSTRUCTIONS FROM GENERAL BRADLEY OR THIS HEADQUARTERS PERIOD IF YOU REMAIN AT ANCHORAGE NOTIFY FAIRBANKS AND NOME IN ORDER TO INSURE YOUR RECEIPT ON ANY MESSAGE FROM BRADLEY TO YOU ADDRESSED TO EITHER OF THESE STATIONS PERIOD ALSO KEEP THIS HEADQUARTERS ADVISED OF YOUR LOCATION

ARNOLD

040116

ORIGINAL TO C of S FOR ACTION

AC FILE

AC JOURNAL

SERIAL FILE

041552

1 Copy sent to 11th AF

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SECRET /lm

RADIOGRAM

PARAPHRASE

269 AG OR 600 URGENT

WASHN D C AUG 041559 Z

COMMANDING GENERAL ADC

FT RICHARDSON ALS

REFERENCE OUR NUMBER FIVE HUNDRED AND FIFTY SIX LT COL KRAIGHER JOINING PARTY DUE FAIRBANKS ABOUT AUGUST EIGHTH AIRPLANE TYPE B TWENTY FIVE BEING SENT BY USSR COMMA RECOGNITION SIGN USSR SEVEN HUNDRED AND THIRTEEN ON AND BELOW WING AND ON BOTH SIDES OF FUSELAGE COMMA STAR ON RUDDERS PERIOD RADIO RECOGNITION SIGNAL PROBABLY SENT IN RUSSIAN QUOTE LA SVOI SAMOLET UNQUOTE IN ENGLISH QUOTE I AM A FRIENDLY PLANE PYROTECHNICS TWO GREEN ROCKETS RADIO CALL SIGNAL RPUDA WORKING SIXTY TWO POINT FIFTY SIX METERS AND EIGHTY SEVEN POINT NINETY EIGHT METERS DUE NOME ANADYR BETWEEN AUGUST EIGHTH AND TENTH TAKE OFF FROM SEIMCHEN FOR NOME WILL BE ADVISED BY RADIO THROUGH ANADYR STATION CALL SIGN R H T U ON TWENTY SIX METERS SOVIETS HAVE BEEN ASSURED RADIO COMMUNICATION WITH ANADYR AT TWENTY TO THIRTY MINUTE INTERVALS EACH HOUR FOLLOWING CODE WILL BE USED FOR WEATHER REPORTS EACH FIRST FIVE MINUTES OF EVERY HALF HOUR AND IMMEDIATELY UPON REQUEST FROM THE POINTS NAMED SEMICOLON TIME COMMA HOUR COMMA MINUTE PERIOD NAME OF TRANSMITTING POINT COMMA NOME A FIFTY NINE COMMA TEBAIDE A SIXTY THREE COMMA CAPE SPENSON A TWENTY THREE COMMA NULATO A THREE COMMA TANANA A NINETY TWO PERIOD CLEAR B SEVENTEEN COMMA RAIN B X COMMA FOG B EIGHTY SEVEN COMMA COMPLETE CLOUDINESS B NINETY SEVEN TEN OF CLOUDS IN METERS B TWENTY SIXCOMMA CLOUDY B SIXTY SEVEN

SECRET

1945

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SECRET

PERIOD ADVISE ANADYR EXACT DETAILS WAVE LENGTHS TO GROUND STATION AND ALSO PLANE AND OF TRANSMISSION TIME WE ARE DEPENDING ON YOU TO INSTITUTE THIS ARRANGEMENT WEATHER TRANSMISSION TO PLANE DESIRED BY SOVIETS ON NAVIGATION WAVE LENGTH WHICH WE PRESUME YOU CAN ARRANGE AFTER GENERAL BRADLEY MOSCOW GIVES CLEARANCE WHICH YOU SHOULD REQUEST YOU ARE AUTHORIZED TO RADIO COMMANDER OF SOVIET PLANE GIVING RECOGNITION SIGNS FOR AIR BRONZE IN FAIRBANKS GALENA AND NOME ALSO ROUTE OF FLIGHT TO APPROACH NOME AND OR OTHER AIR PORTS NAMED AS WELL AS ANY OTHER SECURITY MEASURES YOU DESIRE OBSERVED BY VISITING PLANE SUGGEST IT PACE OF THE HARVEY SURVEY PARTY WORK DIRECTLY WITH YOU STAFF ON THIS MATTER TO ASSURE COMPLETE LIAISON ON RADIO COMMUNICATION WE REQUEST ASSURANCE EXPEDITIOUS ARRIVAL RUSSIAN PLANE NOME OR FAIRBANKS COMMA AND ARE SUGGESTING LATTER SINCE FERRY DELIVERY TO SOVIETS WILL COME FROM FAIRBANKS PARAGRAPH WE PREFER HARVEY PLANE ACCOMPANY RUSSIAN PLANE RETURNING TO SIBERIA THAT ENTIRE SURVEY PARTY MAY ATTEND THEIR SPECIALTIES IN AREA UNDER STUDY PERIOD INFORM HARVEY CONTENTS THIS MESSAGE.

MARSHALL

/041723

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Inspection of Soviet Fighter Airdrome

General Bradley and General Sterligov of the Soviet Air Force made an inspection of a fighter airport on September 5, 1942. The airport was located about 75 kilometers northwest of Moscow. During the drive from Moscow, the highway was blocked at intervals of from 15 to 20 kilometers and even though the party was accompanied by a high Soviet Air Force Officer, it was necessary for everyone to show his pass in order to proceed. The group was met about 15 kilometers from the airdrome by the Air Commander of the district and he escorted them to the field. The squadron based on this field consisted of 24 MEG fighters.

The organization of the airport was similar to army airport organization in the U. S. A. A Base Commander was in charge of the field and a Squadron Commander in charge of the squadron. The Squadron Commander gave orders to the Base Commander, regardless of their relative rank. The Base Commander usually is an over-age pilot.

The personnel on the airport were very military and the officers introduced themselves to the inspection part at attention while at salute. The group was conducted first to the Squadron command post located in a deep dug-out in woods at the edge of the field. This dug-out had only one entrance, but was well ventilated. It was not deep enough to be completely bomb-proof, but gave adequate splinter protection. Telephone and remote control radio wires came into the dug-out through a conduit.

The plotting room was generally similar to fighter plotting rooms in the U. S. There were three maps, each about three feet square. One map was used by the Commanding Officer on duty, one for enemy plotting, and one for friendly plotting. The officer on duty transferred both enemy and friendly plots onto his own map. Maps were covered with cellophane for protection.

Reports are received from ground observers and radio detector stations. A movable arm showing distance and direction is attached to the home airport location on each map. Each airdrome has its own detector station and the plotters are connected directly with it by telephone. The plotters make their plots directly with a pen on the cellophane, using the moveable arm for agimuth and distance. The reports from the radio locator stations are instantaneous and the plotters make about one plot per minute. The plots seemed very accurate. Plots old enough to be of no further value are removed from the map. Friendly planes were plotted for this demonstration. The friendly plotter transfers information from the enemy plotter's board and plans the courses for intercepting planes. The Commanding Officer on duty keeps a rough estimate of the situation by using small lead models on his map. The actual interception orders are given to the planes in flight or on the ground by the radio operator. One large loudspeaker in the dug-out is connected directly to the H. Q. of the Moscow Defense System in Moscow.

Army men are spotted throughout the country at strategic

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spots and report in by radio. These reports are made directly to the main control station in Moscow and this station notified the airport concerned. About twelve minutes are consumed from the time the enemy plane is first sighted until the fighter airdrome concerned is notified of its presence.

The defense system of Moscow or of any given area in the U.S.S.R. is coordinated under one general, who is usually an Air Corps man. This general commands the barrage balloons, search lights, anti-aircraft battery, and fighter aircraft. After inspecting the control center, the party was conducted to the flying field to see the airplanes.

Soviet fighter pilots are kept in three states of readiness:

1. Instantaneous. Pilot in airplane with engine warm.

2. Able to take-off within 15 minutes. Pilots in vicinity of their airplanes.

3. Able to take-off within two hours. Pilots on the airport.

The pilots on instantaneous alert are kept sitting in their airplanes for a two-hour stretch and then are replaced by reliefs. A mechanic is stationed beside each fighter, and a telephone operator wearing a headset is provided for each pair of fighters.

The MIG fighters were parked in individual excavations, the roofs of which were covered with sod. A ramp with a 30 degree angle led down to the floor of the excavation. These excavations were well camouflaged and only the nose of the airplane was visible. All of the airport service installations were well hidden in the woods surrounding the field. Each individual excavation housing the airplanes was separated from its neighbor by approximately one hundred feet. There were twelve of these excavations on the east side of the field and twelve on the west.

A demonstration warning and take-off were made for the American officers present. The fighters work in pairs consisting of a leader and wing man. One pair of fighters is kept on instantaneous alert at all times. As the situation becomes more threatening, other pairs of fighters are placed on an instantaneous alert status. In times of great stress the entire squadron may be in this state of readiness. For the purpose of this demonstration, one pair was given a warning to take-off. Fifty seconds transpired between the reception of the telephone warning and the time both airplanes were airborne.

There were a total of only 120 officers and men in this fighter squadron. Twelve-hour shifts were the rule for all concerned. A bed was located in each excavation for the mechanic not on duty. For each four airplanes, a pilots' rest room was provided and was equipped with four beds for the off duty pilots. The lack of any excess personnel about the airport was outstanding.

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The MEC fighter carries an undetermined number of 23 mm. machine guns. There are no guns in the wings so the armament must be located within the motor cowl. The instruments appear to be serviceable but somewhat crudely manufactured. The air speed indicator is graduated to 800 kilometers per hour. The airplane is well streamlined and looks serviceable. Hand brakes are used entirely. The guns are sighted through an optical sight which seems very good. The sight can be easily lined up by checking it on a spot on the propellor. The Soviet officers present told the party that the MEC will out-perform the Airacobra at high altitudes.

The squadron visited has shot down 120 enemy aircraft that have been confirmed and a total of 190 confirmed and unofficial. 20 of the confirmed victories have been by ramming. The Soviet pilots resort to ramming only after they have exhausted their ammunition, or have jammed their guns. They approach the enemy plane, usually from underneath, and attempt to destroy the pilot by cutting in the pilot's enclosure. In 75 percent of these ramming attacks, the Soviet pilots are able to fly their airplanes home, In the other cases, the propellor or aircraft is so badly damaged, that the pilots are forced to jump. There have been no cases of German pilots resorting to ramming tactics.

The combat squadron is completely air borne and highly mobile. All equipment which cannot be carried by air is base equipment. Combat squadrons are never moved until new base is ready for them. Air transports and motor transportation are provided or arranged for by the base. Base even runs messes for combat squadron. Apparently the combat squadron has one job--to fight.

Summary

1. Soviet airport organization is similar to U. S. airport organization. That is, there is a Base Commander in charge of the base and a Squadron Commander in charge of the combat squadron. The combat squadron Commander has command regardless of relative rank.

2. Great military discipline was observed throughout the Soviet Air Force.

3. Reporting, plotting, and interception of enemy planes is generally similar to U. S. practices.

4. Soviet fighter planes, when on instantaneous alert, can get into the air in less than one minute.

5. The basic combat element in a Soviet Fighter Squadron is composed of two airplanes.

6. The combat squadron is completely air-borne and highly mobile.

7. Combat squadrons' only duty is to fight. Air Base Commanders take over all other duties.

8. A Soviet Fighter Squadron has 120 officers and men. This number is only enough to fly the airplanes and to do servicing and maintenance. All other work is done by the air base personnel.

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Sept. 6, 1942

Reports of Soviet Light Bombardment

Squadron Inspection

The airport inspected lies north of a main road running west from Moscow. It is located about 40 miles from the center of the town and about 40 miles behind the front lines. Some of the farm buildings along the road to the field were being used for offices, quarters, oxygen storage, etc. A large truck was parked beside one of these buildings and was covered by canvas. From its general shape it was thought to be Radar equipment or some other type of radio locator.

The field itself was approximately 1 mile square. The surface was natural sod and it was generally very rough. The whole field was slightly rolling, so one could not see its entire surface from any one point. Judged from United States standards, the surface of this field would be considered poor. From the point of view of obstructions, it was excellent as the surface was higher than that of the surrounding country giving landing airplanes unobstructed approaches from all directions. The drainage would be fair in wet weather because of the sloping nature of the ground.

The camouflage of the field and surrounding territory was superior. No airplanes were visible throughout the drive from the entrance of the field to the Command Post. The east side of the airport bordered on a heavy pine forest and this forest hid all the equipment and personnel so that from the air or the ground the field was apparently deserted.

Revetments

When one approached within 200 feet of the edge of the woods, the revetments concealing the bombers became vaguely visible. A square portion of the brush and trees had been cut out leaving room in which to park an airplane. Three sides of this cleared space were walled up to a height of ten feet with six inch spruce logs, giving the airplane some protection from flying splinters, in the event of a close bomb. The top of the walled-in space was covered by a camouflage net covered with garlands. In front of the revetment was a quantity of small pine trees which were layed directly against the wings of the parked airplane and in front of the pines were a series of permanent small holes dug into the ground. Into these holes small pines trees were fitted and neither the revetment or the airplane was visible from any angle at more than 200 feet. It is well to mention that the revetment was carefully camouflaged whether it was occupied or not. Within three minutes after the time that a bomber left its revetment, the small pines had been reinserted in their holes and the forest line was unbroken once more.

Briefing

The Bradley party left ehri cars at the edge of the forest and the cars were hidden in the woods at once. They were then escorted into

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the trees for a distance of about 100 feet, to what was apparently the squadron briefing room. It consisted of rough tables and benches covered by a camouflage net entwined with garlands. A bulleting board was placed in front of the benches.

It was announced at this point that a squadron commander was at present briefing his crews for a mission that was to take off to bomb a German objective within an hour. With the aid of two interpreters accompanying the party, it was possible to follow the gist of the briefing.

The objective was a German-held railway yard and supply dump and this was outlined briefly to the crews. Check points were announced and, since the weather at the objective was doubtful, a secondary objective was given. The bombing altitude was given as 4,000 meters, but the crews were advised that if the weather was unfavorable a minimum bombing altitude of 800 meters would be permitted. If the ceiling went below 800 meters at the primary objective, the bombs were to be dropped on the secondary objective.

The question of escorting fighters was discussed at this time. The bombers were to pick up a squadron of fighters at an airport nearer the front lines and would be escorted by the fighters to the objective, and back across the lines.

Radio communication was discussed with the aid of a small radio chart. This chart showed the lead plane in communication with the home airport, and the fighter airport, as well as with the leader of each of the other two elements. The formation consisted of a Vee of Vee's with nine ships comprising the whole flight--three in each element.

The squadron commander then announced who would take over command if he was shot down and named two alternates. Then he asked if there were any questions. There were none, so he spent five minutes asking various members of the squadron questions on what he had just told them. When this questioning was finished he gave the order to go to the airplanes. The men left for their ships about 45 minutes before the time set for take-off.

The PE2 Medium Bomber

The bomber used for this raid was the PE2. It is a bi-motored low-wing airplane with a twin tail. The motors are in-line liquid-cooled engines developing about 1300 H.P. at 2550 R.P.M. for take-off. They are equipped with three-bladed constant speed propellors which turn 2500 R.P.M. for take-off. The ship carries a crew of three. The pilot sits well forward in the nose and the entire floor of his cockpit is covered with glass. This glass is red lined from front to back, and the line is used to center the target when the ship is used as a dive bomber. In dive bombing, the bombs are released by the pilot, but in horizontal bombing they are released by the navigator.

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The controls in the pilot's cockpit are conventional. The flaps and trim tabs are electrically operated while the propellers are hydraulic. The braking system is operated by air and is controlled by a lever on the yoke. There are no foot brakes and it is not clear how one brake is actuated without the other one.

The instruments are conventional, comprising a giro blind-flight group, one compass, tachometers, manifold pressure gauges, coolant temperature gauges, head temperature gauges, sensitive altimeter, and several other instruments that were not explained. Generally speaking, the pilot's instruments appeared adequate for the airplane.

The pilot's seat is completely armored with 3/8 inch steel plate. The plate is curved around the sides of the seat for a distance of two inches and completely covers the bottom of the seat. The armor is carried the full width of the seat as high as the shoulders of the pilot and then tapered in to form a cup which completely covers the back of the pilot's head.

The navigator's compartment is located directly behind the pilot's seat. A mount is provided on the floor to accommodate either a bomb sight or a drift meter. Signal flares and map compartments are located around the sides of the cabin. No provision is made for a map board.

The bombay and gas tanks are located behind the navigator's compartment and take up about six feet of space between the navigator's compartment and the radio operator's compartment in the rear. There is a small compact transmitter and receiver located in the radio operator's compartment. The compartment is armored by one large plate of 3/8 inch armor beginning at the back of the compartment and curving up over the turret gun. This plate should provide excellent protection from attacks made from above the tail but there is no armor provided for protection from attacks from beneath the tail.

Armament

The armament of the PS2 consists of three 50 caliber machine guns and two 30 caliber machine guns. One 50 caliber and one 30 caliber are fixed in the nose of the airplane and are fired by the pilot from an electric button in the center of the yoke. An optical sight is provided for aiming these guns. The navigator has one 50 caliber machine gun firing rearwards from the top of his compartment, which provides excellent protection from attacks from above. The radio operator has one 50 caliber gun firing in the turret position and aimed through an optical sight. The Soviets are very fond of this installation and consider it the best gun on the ship. There is a mount on each side of the radio operator's compartment and one 30 caliber gun is provided which can be transferred at will from one side to the other.

The bombay is located at the bottom of the fuselage and is very small. The dimensions are roughly 3 x 3 x 4 feet. The bombay carries four

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four 100 kilo bombs nestled two on the bottom and two above. The racks and space will accommodate only this one size of bomb. The bombay doors close completely over the bay itself and the streamline is maintained.

There are two external bomb racks provided, one located on each wing between the motor mount and fuselage. These racks carry a 250 kilo bomb. The external racks or the bombay racks are used, but never both. Thus the total bomb load with the internal racks is 500 kilos, while 500 kilos are carried if the external racks are used.

General Construction

The construction of the PE2 is generally good. The whole external surface of the ship is flush riveted. Metal construction is used throughout, even to the covering of the ailerons and elevators. Fairing of abrupt contour changes is thorough and streamlining appears to be very good. The propellors are provided with a means to dispense anti-icer fluid to the blades, but no boots or provision for boots are evident on the wings.

The gas tanks are constructed from dural and no attempt has been made to render them leak-proof. On all Soviet combat airplanes, however, the gas tanks have a safety device which is said to be very effective in the prevention of fire. The tanks are vented to CO_2 bottles and as gasoline is burned the tank is filled with CO_2. In this manner an inflammable mixture of gas vapor is never present in the tank.

The only part of the PE2 construction which is rough is the manner in which the sheet metals has been cut. The metal appears to have been cut out by hand and many irregularities are evident.

The fuselage is full monocoque. The main landing gear wheels retract into wheel wells behind the motor, and the tail wheel retracts fully into the fuselage. Flaps are located between the inboard end of the aileron and the edge of the fuselage. The PE2 resembles a U. S. A-18 with in-line engines. It has a wing spread of about 45 feet.

Maintenance

Beside each bomber was an air flask carrying 2,500 pounds of pressure. This air was used for starting the engines. The engines burn 92 octane gas.

Each revetment was equipped with a small tool box but more tools would be needed for anything but the smallest repairs. One ship was undergoing an engine change. Maintenance was generally good, although one ship was flying with a ragged bullet hole in a propellor blade.

After inspecting the Pe2, the party was conducted to a high spot on the airport to observe the take-off. Complete camouflage discipline

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was maintained up to the time of starting the engines. A green rocket was fired from a central point to signal the pilots to start their engines. The engines were started and the camouflage removed from the front of the revetments very quickly. The planes were taxied out and the revetments at once were covered again by the spruce trees.

The take-offs were made individually, and only ten minutes transpired between the time that the engines were started and the time that the last ship left the ground. Half flaps were used by all planes. The roughness of the field combined with the short travel of the shock struts made each take-off appear hazardous. A run of about 2,500 feet was used before a ship got into the air and when it did get off, it appeared to be in a stall and did not fly normally or gain any altitude for another 2,500 feet.

The ships made one complete circuit of the airport, picked up their formation, and flew away to the northwest. Nine bombers made up the whole formation but ten were taxied out for the take-off. The spare plane was included to insure a full flight of nine would actually take the air.

Aerial Photographs

During the time that the bombardment planes were out on their mission, General Bradley and the members of his party were shown a series of aerial photographs of the results of former missions. These pinpoints and mosaics were clear and correctly exposed and one could easily observe the accuracy of the Soviet bombing. Two objectives were shown, each of which appeared to be a German airdrome of considerable proportions. Concrete runways were visible and numerous single engine German aircraft were dispersed, without camouflage, around the edge of the field. Pictures were then produced which showed bombs landing among these parked aircraft.

The Soviet officers present informed the group that the Soviet air force made considerable use of aerial photographs, both to show an objective before a raid, and to indicate the damage done during a raid. All of the PE2 planes have provision for cameras and at least one is carried on every raid. The PE2 is always used in formation during bombing raid in order to take advantage of mutual protection by cross fire. The ships are used frequently as photographic reconnaissance airplanes, and when used in this manner they are flown singly.

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The camera may be controlled remotely by the pilot or operated directly by the radio operator. There is a mount in the floor for vertical photography and one in the side of the fuselage for oblique photography. All the photographs observed were verticals.

German Air Tactics

The party was informed that the squadron which had taken off had been attacked by German fighters about one week ago. The attacking group comprised 21 Junkers 88's and 18 Messerschmidts 109's. The Soviet bomber squadron was under the protection of a squadron of Soviet YAK fighters at the time. The Germans lost 9 Junkers 88's and the Soviets lost no planes.

The commanding officer of the squadron informed the members of the party that the Soviets were generally more successful in aerial combat than the Germans, but were hampered by a lack of airplanes. He said that German fighters usually did not open fire until they were within 200 meters of the Soviet airplanes. Soviet fighters open fire at 400 meters, and Soviet bombers at 600 meters.

About one hour and forty minutes after the bombers had taken off, they returned to the field at ground level. During the time they had been gone, three radio reports had been received which were translated for the benefit of our party. The first message reported that the fighter escort had been met successfully and that the bombs had been dropped on the target and were seen to start fires. The second message stated that the planes were returning, and the third that there had been no injury to the personnel.

The landing of all the aircraft was observed and appeared even more hazardous than the take-off, due again to the roughness of the terrain. During the take-off and the landing of the squadron a fire truck and an ambulance appeared from the forest and stood by in case of an emergency.

The same camouflage discipline was observed after landing as after take-off. The ships were taxied promptly to their revetments and backed in and the camouflage replaced in front of them. Two gas trucks drove out of the forest and servicing was begun at once. Trucks loaded with bombs stopped at each revetment and deposited each airplane's new load.

The pilots were questioned by the squadron C.O. as soon as they could assemble from their ships. They reported hits from most of thier bombs and much damage observed. They had encountered heavy A. A. fire at and near the target and some of the ships had been damaged slightly by shrapnel. On the way home they had been attacked by enemy fighters but the fighters had been beaten off by the Soviet fighters. All ships returned to their base safely.

After the briefing, the members of the Bradley Mission and the Soviet pilots and navigators of the squadron, all of whom were commissioned officers, were invited to the officers' club, a building hidden in the forest, for supper. Despite the language difficulty, the personnel of both countries got along admirably together and learned a great deal about each other.

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The impression created in the minds of the Americans after observing the Soviet squadron for one afternoon was that the Soviets were very efficient in all that had been observed. Their equipment, in a few instances appeared rather crude, but in every case each was efficiently used. The airplanes were well handled as far as one could observe, but the roughness of the field made an accurate estimate of their flying ability impossible.

Summary

1. Soviet camouflage discipline is superior.

2. The Soviet Air Force makes use of revetments, camouflage, and dispersal. All three are used to as great a degree as possible as the surrounding terrain will permit.

3. Soviet bombing squadrons are not only briefed with maps and photographs but the crew members are questioned in detail about the briefing to insure that every man knows his job thoroughly.

4. The PE2 medium bomber, sometimes called the Stormovick, is a very good airplane.

5. Soviet airplane armament is generally good.

6. Great use is made of aerial photographs in the Soviet Air Force.

7. Plane for plane the Soviets seems superior to the Germans in the air, but are hampered by a lack of airplanes.

T. J. Watson, Jr.
Captain, A. C.

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Maintenance and Servicing Facilities - Spare Parts

Servicing facilities for gas and oil were modern and efficien at Baku, Kuibyshev, and Moscow, which are the only airports that have been used by the B24 up to the present time. A separate truck is used for gas and for oil, and the oil trucks have some means of heating the oil for winter use. The gas and oil pumps are operated by the engine of the truck and do not have a separate pumping engine as is the custom in the U. S. The pumping rate of the truck is slow and a complete servicing of an airplane probably consumes about one third more time in Russia than it would consume in America. 100 octane gasoline is available at most large airports if some notice is given.

While in Moscow it was necessary to have some parts constructed for the landing gear doors of the B24. The parts were well made and fitted perfectly. One can assume from this experience that spare parts can be made in Russia for American aircraft, although any major replacements would be impossible. Oxygen is available at all the large airports, but recharging with oxygen in large quantities is a tedious job, because after the pressure in the recharging bottle is reduced it is necessary to pump in the rest of the oxygen by hand. One of the rubber gas lines running between the wing tanks of the B24 was replaced in Moscow. No bullet-proof hose is available, but ordinary rubber hose can be procured and is of a serviceable type.

Maintenance of Soviet Aircraft

The maintenance of Soviet aircraft in general can be said to be adequate. It cannot compare with U. S. Army maintenance. This is caused by a lack of maintenance personnel and, in some cases, lack of proper facilities. Engines are generally dependable but miss and splutter at times and are still kept in service. Warming up of engines, or testing magnetos as it is done in the U. S. is unknown here. The airplanes of the Soviet Air Force usually leave a trail of black smoke in the air when flying. It is thought that this is caused by the use of a low-octane gasoline. Few airplanes appear to be cracked-up due to poor maintenance as no wrecks were observed on the interior airports visited. When the roughness of the average Soviet field is considered, the fact that there are no wrecks is amazing.

Most Soviet airplanes are started by air. This air is brought to the ship in large bottles with 2,500 pounds of air pressure. These same flasks are used for blowing up oleo struts and for inflating tires, etc. One of the flasks was used to blow up an oleo strut on the B24D and an estimated weight of 1,800 pounds rested on the strut, but the flask blew up the strut with ease.

Summary

1. 100 octane gasoline is available at most important Soviet airports.

2. Small parts can be manufactured, with some difficulty, for American aircraft in Russia.

3. Oxygen is available at most large airports.

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4. Servicing is generally slow.

5. Maintenance of Soviet aircraft is adequate but below American standards.

6. Use of high pressure air flasks simplifies many servicing problems.

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in the Baku beacon when about 100 miles north of Tehran. North of Baku, there are homing beacons at Astrakhan, Kuibyshev, and Moscow. Some of these stations are regular broadcast stations and music and voice could be heard on them, while others emitted a steady buzz similar to a normal homing station. The buzz was continuous and was not broken by any type of identification signal so identification must be obtained by dial setting alone.

The range of the homing stations is about 400 miles. When homing on a distant station, some difficulty was experienced because the signal was not sufficiently strong to energize our radio compass. The compass set carried was SCR 269C and used an automatically turning loop and, at times, it was possible to hear a station plainly for 45 minutes to an hour before the signal became strong enough to energize the loop and cause it to center on the bearing.

The Kuibyshev homing frequency is 360 kilocycles.

Summary

1. Radio communication in western Russia using C W is adequate.

2. No voice transmission is used by aircraft in the Soviet Union.

3. Soviet radio operators are necessary on all ships operating in Russia as the Russian code is not the same as the International Code and Q signals are not used.

4. There are radio stations on which one can home throughout the Soviet Union. These provide the most practical means of air navigation and are used exclusively by Soviet airplanes for this purpose.

5. The SCR 269C Radio Compass Receiver is not practical for installation on airplanes operating far from facilities for complex radio maintenance. The use of a simple compass receiver employing the small instrument with the needle indicating "right" or "left" is recommended.

6. Soviet radio construction is generally primitive.

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Radio Communication

Plane to Ground:

The B24D used by the Bradley Mission carried a Russian radio operator on all of the trips made within the Soviet Union. The total flying time for the ship in Russia amounts to about 40 hours at the time of writing this report. All plane-ground communication was carried on in code, and as the Russian code is not the same as the International Code, it was impossible to get a definite check on what was getting through successfully. From close observation of the radio operator by the writer and the American radio operator, it is possible to draw several general conclusions.

The operator had no difficulty in getting messages through without delay. He kept a complete log of all his traffic and his form had a space to check for "Received O.K.". Nearly every attempted contact would be checked within five minutes of the start of transmission.

The Russian operator went over the equipment when he first got on board with our own American operator. Without the aid of an interpreter, he was able to learn enough about the equipment, to operate it, without trouble, at all times.

The fact that it was never necessary for the Russian operator to use the trailing antenna gives some indication of the distance between stations in the Soviet Army Airways Net. The range of the set is reduced considerably by using only the fixed antenna but contact was always quickly made whenever attempted. Using the above as a measuring stick, it is estimated that on the route from Tehran to Moscow, via Kuibyshev, radio stations are spaced not more than 400 miles apart.

There are apparently no constant listening watches maintained on any one frequency for the entire country. When the operator called a different station, it was often necessary for him to change his transmitting frequency. For this reason, it is believed that there is no separation between air-ground and ground-ground traffic. Each individual ground station has a sending and receiving frequency assigned it and it guards only this one assigned channel.

All the frequencies used by the Russian operator on the B24 ranged between 4000 and 5000 kilocycles. The operator transmitted at between 14 to 18 words per minute. No International Q signals were used and it was not determined whether or not such signals were ever used in Russia. The operator used 4325 kilocycles in transmitting to Moscow and Kuibyshev.

The Russian operator was full of admiration for the American radio equipment installed in the B24D. He said it was the finest he had ever worked with. Russian aircraft sets examined were made with very simple circuits and crude tubes.

Radio Compass and Homing Facilities

The use of the radio compass for air navigation is wide spread in Russia. On the route from Tehran to Moscow, one can tune

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Irma Christopher
Officer
Classified Mail Unit
10/24/42
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P. Lacey
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Copy 2

dated 10/8/42

Chas A McCarthy CSC
Officer Rank

For Capt Robbins
Comench 2-14
Office

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OCT 21 1942

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W. J. Schulgen Col AC
Officer Rank

Asiatic Theater
Office

NOTE: To be accomplished and returned to ~~the Adjutant General~~ Col. Alva L. Harvey, A.C.

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W-4759, A. C.

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H. Gen Curtis
Officer Rank

ADS 10/7/42
Office

NOTE: To be accomplished and returned to ~~the Air Adjutant General~~ Col. Alva L. Harvey, A.C. Plans Division, Air Staff Room 2117, Munitions Bldg.

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W-4759, A. C.

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dated 10/8/42.

G. E. Disco Maj.
Officer Rank

A-3
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M. Thiele - 10-19-42
Officer Rank

Office

NOTE: To be accomplished and returned to ~~the Air Adjutant~~ Col. Alva L. Harvey, A.C.

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Officer Rank

Colonel Williamson

Office

NOTE: To be accomplished and returned to ~~the Air Adjutant~~ Col. Alva L. Harvey, A.C.

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SUBJECT: Report of Alaskan-Siberian Survey Flight.

Receipt is acknowledged of Report for the Chief of the Air Staff, subject above (Copy #1) dated 10/8/42.

Hq. Army Air Forces
OCT 22 1942
AAG Received

W D Gray, R. 2013
Officer Rank

Office of Army

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Plans Division, Air Staff
Room 2117

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REPORT OF

ALASKAN-SIBERIAN SURVEY FLIGHT

BY

COL. ALVA L. HARVEY, A.C.

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REPORT OF

ALASKAN-SIBERIAN SURVEY FLIGHT

I N D E X

Summary

Operations and Airports . . . . . .Tab 1

Supply . . . . . Tab 2

Communications . . . . . Tab 3

Weather Facilities . . . . . Tab 4

Sanitary Conditions . . . . . .Tab 5

Route Capacity . . . . . Tab 6

Health Precautions for Siberia . . . . . Tab 7

Memorandum for Gen. Bradley from Col. Harvey . . . Tab 8
(requesting additional information)

Letter to Gen. Bradley from Gen. Sterligov . . . . Tab 9

- By -

COLONEL ALVA L. HARVEY, A.C.

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REPORT -- ALASKA-SIBERIA SURVEY FLIGHT

October 7, 1942.

Attached hereto in the form of inclosures is a report as submitted by officers of the Siberian Survey Mission, conducted during the period August 26 to 31st, 1942. Subjects of individual reports as follows:

1. Operations and Airports
2. Supply
3. Communications
4. Weather Facilities
5. Sanitary Conditions
6. Route Capacity
7. Health Precautions for Siberia
8. Memorandum for General Bradley from Colonel Harvey (Requesting additional information)
9. Letter to General Bradley from General Sterligov

No details of airdromes west of Krasnoyarsk are included as they are considered first class. The route approval was recommended to General Bradley upon the flight's arrival in Moscow with the reservation that amounts of fuel and oil stored at terminals east of Krasnoyarsk were unknown. However, we were told at all stops by airport representatives that there were sufficient fuel and oil for contemplated operations. General Bradley also stated that he had been given the information that sufficient fuel and oil were spotted at teach airport to insure sufficient service for the number of planes to be moved over the route.

The condition of each landing field, their distances apart and the radio and weather facilities available indicate that equipment of single- and two-engine types having a range of 1200 to 1400 miles could be moved over the route without great difficulty. The ground radio network and the ground-to-air communications appeared to be excellent. Stations are used for homing and D.F. facilities are available at each stop. The weather facilities, number of reporting stations, and forecasts as presented seemed to indicate adequate weather reports for safety of operations. The Russian pilots gave the impression of having fullest confidence in the forecasts received.

The survey party was not allowed great latitude for inspection but there was evidence of shortages of servicing and maintenance equipment. As to amounts of fuel on hand there are no storage tanks in evidence. However, the surrounding country is ideal for dispersion and comouflage.

Modern airports and training fields were seen at frequent intervals between Krasnoyarsk and Moscow. Most of them have good hard surfaced runways, especially those at Krasnoyarsk, Novo Sibirsk, Omsk, Sverdlovsk, Kazan and Moscow.

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It is the opinion of the writer and others of the mission that extensive military operations in the area surveyed east of Krasnoyarsk would require many months of preparation. All bases would have to be put into condition to house personnel and supplies. All supplies would necessarily have to come in from the Arctic Ocean by river boats, and these rivers are free of ice for only a short period each year. The Lena River, on which Yakutsk and Kirensk are located, is believed to be deep enough to allow passage to fairly large steamers. The Bereloch River, on which Bereloch is located; the Kalyma River, on which Semchan is located; and the Anadyr River, on which Markova is located are not considered of sufficient depth or width to allow passage of large steamers. These latter stations would undoubtedly have to be supplied by tugs and barges.

ALVA L. HARVEY,
Colonel, Air Corps,
Commanding.

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Moscow, U.S.S.R.,
September 4, 1942.

Inclosures No. 2 To Letter From General Bradley To
General Sterligov, Dated September 4, 1942.

OPERATIONS AND AIRPORTS

1. Summary of the trip:

Airport & Time		Elapsed Time	Km.	N.	M.P.H.
Aug. 26-27*					
Nome	11:45				
Semchan	20:25	8 hrs. 40	2,070	1,282	148
*International Date Line.					
Aug. 28					
Semchan	9:50				
Yakutsk	14:30	4 Hrs. 40	1, 180	731	157
Aug. 29					
Yakutsk	11:00				
Kerensk	17:00	6 hrs.	1,290	800	134
Kerensk	18:10				
Krasnoyarsk	22:30	4 hrs. 20	940	582	134
Aug. 30					
Krasnoyarsk	10:00				
Omsk	15:30	5 hrs. 30	1,240	768	140
Aug. 31					
Omsk	6:40				
Sverdlovsk	10:20	3 hrs. 40	810	502	138
Sverdlovsk	11:45				
Moscow	18:15	6 hrs. 30	1,450	898	138
		Total	8,980	5,563	140

All times are meridian time from point of departure.

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2. Airports.

Markova:

Latitude:	- 64° 45' N.
Longitude:	- 171° E.
Altitude:	- 25 M.
Runway:	- one.
"	- direction E-W.
Dimensions:	- 1000 M. x 50 M.
Surface:	- black loam, rolled and graded.
Drainage:	-
Expansion possibilities	- unlimited.
Windsock:	-
Markings:	-none.
Lighting facilities:	- none.
Approaches:	- good.
Fuel and oil:	- (reported available).
Means of furnishing supplies:	- (Anadyr River).
Hangar:	- none.
Shops:	- none.
Meterorelogical service:	- available.
Radio:	- yes.
Accommodations and food	- (food limited, quarters being built).

Semchan:

Latitude:	- 62° 52' N.
Longitude:	- 152° 26' E.
Altitude:	- 170 M., 2 km. SW of village.
Runway:	- one (not paved).
"	- direction N-S.
Dimensions:	- 1,200 M. x 100 M. (being enlarged to 300 meters).
Surface:	- rocky loam, natural and graded.
Drainage:	- wooden rectangular drainpipes, according to local advice satisfactory.
Expansion possibilities	- good.
Windsock:	- yes.
Markings:	- none, except wooden markers for runway.
Lighting facilities:	- none permanent.
Approaches:	- good.
Fuel and oil:	- available.
Means of furnishing supplies	- (road) river boats and air.
Hangars:	- none.
Shops:	- none.
Meterological service:	- available (good).
Radio:	- yes.
Accommodations and food	- satisfactory for limited number of men (50).

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Berelech: - (approx. 200 km. w. of Semchan).

Latitude:	- 62° 45' N.
Longitude:	- 148° 10' E.
Altitude:	- 635 M.
Runway:	- one
"	- direction N. W-E. (mag.)
Dimensions:	- 1,000 M. x 100 M.
SSurface:	- rocky loam, rolled and graded.
Drainage:	- good - natural.
Expansion possibilities:	- good.
Windsock:	- yes.
Markings:	- none (except wooden runway marker).
Lighting facilities:	- none permanent.
Approaches:	- good (but field is surrounded by mountains up to 2,300 M. hight).
Fuel and oil:	- available (limited).
Means of furnishing supplies:	- water.
Hangars:	- none.
Shops:	-none.
Meteorological service:	- available (good).
Radio:	- yes.
Accommodations and food:	- satisfactory for limited number of men (30).

Yakutsk:

Latitude:	- 62° N.
Longitude:	- 129° 40' E.
Altitude:	- 320 M. 8 km. N. of town.
Runways:	- three (not paved).
Dimensions:	Direction In Degrees Approximately:
1,400 x 100 M.	- 10°
1,600x 100 M.	- 45°
1,200 x 100 M.	- 120°
Surface:	- sandy loam - natural.
Drainage:	- good-natural.
Expansion possibilities	- good.
Windsocks:	- yes.
Markings:	- wooden markings on runway, otherwise none.
Light facilities:	- none permanent.
Approaches:	- good.
Fuel and oil:	- available.
Hangars:	- none.
Shops:	- none.
Meteorological service:	- available (good).
Raidio:	- yes.
Accommodations and food:	- satisfactory for limited number of men (100).
Means for furnishing supplies	- river boat, road and air.

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Irkutsk

Latitude:	- 58° 30' N.
Longitude:	- 108° 10' E.
Altitude:	- 400 M. (approx.) 2 km. W. of village.
Runway:	- one, not paved.
Dimensions:	- 1,200 x 100 M. Direction E-W.
Surface:	- sandy loam, natural.
Drainage:	- satisfactory.
Expansion possibilities	- good
Windsock:	- yes
Markings:	- wooden runway markings, otherwise none.
Light facilities:	- none permanent.
Approaches:	- good
Hangers:	- none.
Shops:	- none.
Metmrological service:	- available
Radio:	- yes.
Accomodations and food:	- satisfactory for limited number of men (approximately 20).
Means of furnishing supplies:	- river boat and air.

Krasnoyarsk:

Latitude:	- 56° 05' N.
Longitude:	- 92° 50' E.
Altitude:	- 160 M.
Runways:	- two - paved - concrete.
Dimensions:	- 1,100 x 100 M. (plus 100 M. narrow extension, concrete taxi strips and parking areas.) (The field, approximately 1 mile square, available for light planes.)
Surface:	- sandy loam.
Drainage:	- good.
Expansion possibilities	- good.
Windsock:	- yes
Markings:	- yes
Lighting facilities:	- none permanent (runway lights).
Approaches:	- good.
Fuel and oil:	- available.
Hangars:	- four (medium size) wood construction.
Shops:	- in town
Meteorological service:	- available (good).
Radio:	- yes
Accomodations and food;	- satisfactory for larger number of men (200).
Means of furnishing supplies:	- river boat, railroad and air.

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3. Route.

Nome - Anadyr: - Across Bering Straits and Gulf of Anadyr, skirting the southern shores of Cape Chaplin, which are rocky, barren cliffs. Hardly any population.

Anadyr - Markovo: - Across land consisting of low, swampy tundry with occasional sparsely wooded rolling hills. Extremely sparsely populated.

Markovo - Semchan: - Rolling wooded hills changing to mountainous country. Pine and spruce forests. Elevation gradually increasing to approximately 6,000 feet. Extremely sparsely populated.

Semchan - Yakutsk: - Continuing mountainous country with elevations increasing to approximately 11,000 feet, and descending to the plains east of Yakutsk. Extremely sparsely populated.

Yakutsk - Krasnoyarsk: - Low rolling wooded country with frequent areas of tundra. Very sparsely populated.

Krasnoyarsk - Urals: - Low flat country gradually becoming more cultivated and populated approaching the Urals.

Urals - Moscow: - Low rolling country, with forests, intensively cultivated and more populated.

The country east of Krasnoyarsk and particularly east of Yakutsk offers hardly any natural open landing grounds. The low flat lands are swampy tundra and all higher dry land is wooded and mostly uneven. In winter, of course landings may be made on frozen rivers, lakes and tundras if the snow conditions permit.

4. The route as at present (assuming that the airport and refueling facilities are available at Velkal) will have airports at intervals not exceeding 1,300 kilometers (800 miles), and is flyable with reasonable safety factor by aircraft having a cruising range of approximately 2,000 kilometers (1,250 miles).

The meteorological and radio communications and navigation facilities appear to be satisfactory, which is substantiated by the fact that the Russian crews of the B-25 and DC-3 of the survey party negotiated the route without any difficulty under relatively adverse weather conditions.

5. Recommendations for improving the present Moscow - Nome routes:

Airports: - Approximately every 800 kilometers (500 miles) it is desirable to have a first-class airport consisting of:

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Paved runways: - One to three, depending upon wind conditions. One runway - 1,600 M. x 100 M. The other approximately 1,300 M. x 100 M. Good approaches.

Night landing facilities - All necessary facilities for refueling and maintaining aireraft - for year round operation.

Complete radio communications and radio navigation facilities.
Complete meteorological facilities.

First-class airports would be required at least in:

Vicinity of Anadyr
Semchan
Yakutsk
Kørensk
Krasnoyarsk
Novosibirsk
Omsk
Sverdlsvak
Kazan
Moscow

In between the first-class airports at intervals of approximately every 400 kilometers (250 miles) it is desirable to have second-class airports (auxiliary) consisting of:

Runways: - One to three depending upon wind conditions. One runway 1,100 M. (3,600 ft.). The others approximately 1,000 M. (3,280 feet).

Good approaches;
Night Landing Facilities:
Maintenance Facilities:
Radio Facilities:
Meteorological Facilities:

The selection of sites for auxiliary airports should be made as soon as possible and work on airports started in order to take advantage of the winter months, at which time it will be possible to haul construction men and supplies by planes equipped with skis. This is particularly advisable for the airport sites east of Yakutsk which are mostly inaccessible except by air. The airport sites should be selected preferably alongside of rivers or lakes which can be used as landing fields when frozen.

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Suggested Basic figures for estimates:

Planes: - Transports (Douglas DC-3) 240 k.p.h. (150 m.p.h.)
Light bombers, pursuits 280 k.p.h. (175 m.p.h.)
Transport planes - 4 hrs. per day - 120 hrs. per month.

Remarks: - 4 hours per day per plane is relatively low; however, in view of limited night operation and difficult weather this estimate will be hardly exceeded.

Itinerary of the Return Trip from Moscow to Fairbanks, Alaska

September 19, 1942

Moscow	8:20
Sverdlovsk	13:30
Elasped time	5 Hrs. 10 Min.

September 20

Sverdlovak	6:20
Omsk	9:30
Elapsed time	3 Hrs. 10 Min.
Omsk	10:35
Krasnoyarsk	15:20
Elasped time	4 Hrs. 45 Min.

September 21

Krasnoyarsk	6:10
Krasnoyarsk	6:25
(Returned because of loose propeller spinner)	
Krasnoyarsk	6:35
Kørensk	10:20
Elapsed time	3 Hrs. 45 Min

September 23

Kørensk	8:30
Yakutsk	14:35
Elapsed time	6 Hrs. 5 Min.

September 24

Yakutsk	12:10
Berelok	16:05
Elapsed time	3 Hrs. 55 Min.

September 25

Berelok	14:55
Semchan	16:05
Elapsed time	1 Hr. 10 Min.

October 2

Semchan	10:15
Markovo	14:10
Elapsed time	3 Hrs. 55 Min.

October 3

Markove	10:05

October 2*

Nome	15:15
Elapsed time	5 Hrs. 10 Min.

*International Date Line

October 3

Nome	8:55
Fairbanks	12:15
Elapsed time	3 Hrs. 20 Min.

VELKAL

Latitude - 65° 35' N.
Longitude - 180° 25' E.
Altitude - 10 M.

This airport was not visited by survey party and, therefore, no further details are available. However, according to information received from the Russian Officers, this airport is satisfactory for aircraft of Douglas DC-3 type.

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Moscow, U.S.S.R.
Sept. 4, 1942

Inclosure No. 4 To Letter From General Bradley To
General Sterligov, Dated September 4, 1942.

SUPPLY

1. The following landing fields were visited:

Markova (flew over)	Krasnoyarsk
Semchan	Omsk
Yakutsk	Sverdlovsk
Kørensk	

2. With respect to facilities at the fields on the above route, ferrying operations could be started with a reasonable degree of efficiency. However present facilities east of Krasnoyarsk are rather incomplete when judged by American standards, and in the interests of maximum efficiency additional facilities would be desirable. The route from Krasnoyarsk to Moscow is quite satisfactory as the airports are excellent and apparently have the necessary facilities.

3. Maintenance facilities, at fields east of Krasnoyarsk, for the inspection and repair of transient aircraft are nil. Hangars are entirely lacking along this portion of the route, as well as any form of portable enclosed maintenance stands. These facilities are necessary, particularly in cold weather, to adjust malfunctioning engines, effect engine changes and repair airplanes damaged in landing, landing gear failures, ground loops, etc. There is a total absence of any aircraft shops, machinery, and a stock of metals and materials which would expedite the repair of aircraft, particularly in such isolated districts.

4. Cold weather starting difficulties will no doubt be encountered. While the Russian Air Force has an excellent device for turning propellers to start engines, American planes unfortunately are not adaptable to this device and other facilities will have to be available such as:

a. Stewart Warner heaters and hoods for engines.
b. Facilities to drain and war engine oil.
c. Electrical facilities to connect oil submersion heaters (on planes so equipped; this is part of winterizing equipment on American planes).
d. Gasoline operated energizers, battery carts and battery chargers.

5. The supply problem on this route will vary with the transportation facilities and additional supplies required. The problem will become increasingly difficult along the route eastward from Krasnoyarsk due to the fact that the only means of transportation are by water, during certain months, and air. While the amount of fuel at each airdrome was not determined it is assumed there will be sufficient for the ferrying operations intended. However refueling facilities appeared inadequate as they never consisted of more than two trucks of 3,000 litres each. Additional refueling

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trucks and adequate bulk storage would be desirable for any extensive ferrying operations. Supply warehouses were not in evidence and, of course, there was no supply of standard items such as tires, generators, starters, pumps, hydraulic fluid, etc. These supplies can readily be brought in by air but warehouses should immediately be constructed.

6. Living accommodations are rather limited for any extensive ferrying operations as weather may hold up many flights of aircraft. Additional barracks, mess, and toilet and bathing facilities appear desirable.

7. Equipment for clearing or packing snow on airdromes was not in evidence. This is quite necessary, in operation of pursuit aircraft particularly.

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September 4, 1942

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trucks and adequate bulk storage would be desirable for any extensive ferrying operations. Supply warehouses were not in evidence and, of course, there was no supply of standard items such as tires, generators, starters, pumps, hydraulic fluid, etc. These supplies can readily be brought in by air but warehouses should immediately be constructed.

6. Living accommodations are rather limited for any extensive ferrying operations as weather may hold up many flights of aircraft. Additional barracks, mess, and toilet and bathing facilities appear desirable.

7. Equipment for clearing or packing snow on airdromes was not in evidence. This is quite necessary, in operation of pursuit aircraft particularly.

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Moscow, U.S.S.R.
Sept. 4, 1942

Inclosure No. 5 To Letter From General Bradley To
General Sterligov, Dated September 4, 1942

COMMUNICATIONS

1. Investigation and survey of communications show that the temporary system now in use between Alaska and Siberia is satisfactory except as follows. Anadyr radio stations should be provided with additional receiving facilities to enable receipt of certain low frequency signals from Nome. It is suggested that a radio receiver covering 120 kilocycles (2500 meters) be installed immediately at Anadyr to utilize the 4 kilowatt transmitter now permanently installed at Nome.

2. With the above, the Nome-Anadyr channel will provide high, medium and low frequency communications, thus assuring a 100 per cent efficiency contact at all times and under any conditions. If desirable, Fairbanks-Anadyr (or Fairbanks-Yakutsk) high frequency channel may be also established to maintain direct contact between these points. In spite of periodical atmospheric disturbances, these channels may be expected to be not less than 75 per cent efficient.

3. Newly gained knowledge of Siberian radio stations and their equipment, as obtained through this survey, indicates no difficulty may be anticipated at these stations in maintaining communications with Alaskan stations. Contacts between these points may be arranged and made with the least possible loss of time and effort. Details pertinent to frequencies, schedules, etc., may now be easily arranged at any time through radio stations at Anadyr and Nome.

4. Army aeronautical radio stations at Nome and Fairbanks have recently installed eight and ten channel high frequency radio transmitters which, in addition to existing radio ranges, provide dependable communications for aircraft flying to and from Siberia.

5. City of Krosnoyarsk is now the first point west of Alaska where, in addition to DF facilities, a radio range is available. All points east of Yakutsk have only direction finding facilities, operating on both high and low frequencies. All points west of Krosnoyarsk have DF and radio ranges. In addition to these, all radio stations provide special radio compass homing facilities.

6. Recommendations:
It is recommended that radiofare and direction finding equipment be installed at additional stations between Anadyr and Krosnoyarsk at sufficiently frequent intervals to insure uninterrupted direction finding facilities for aircraft.

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Moscow, U.S.S.R.
Sept. 4, 1942

Inclosure No. 3 To Letter From General Bradley To
General Sterligov, Dated September 4, 1942

WEATHER FACILITIES

1. U.S.S.R. and U.S.A. exchange:

At time of departure of the survey party from Alaska a dangerous lack of Siberian weather information, for forecast purposes, was evident. Communications, plus other technical difficulties, such as lack of proper codes for forecasts, etc., appeared to be responsible. The synoptic broadcast from Khabarovsk was heard irregularly at Nome and even less frequent at Fairbanks. When heard, the number of reports was inadequate for proper preparation of forecasts. Negotiations have been completed to bring the total number of reports from Khabarovsk up to 30 and arrangements are in progress to extend this to 45 regularly, plus added pilot balloon and meteorograph observations. The U. S. station is doing likewise. These additional reports will be of no benefit along this route unless they can be consistently received at Nome, and, if possible, at Fairbanks. In this connection it is understood that the reports desired are not available at Anadyr, but are available at Yakutsk and further. A test broadcast has been proposed by the Soviets from Yakutsk to Nome. If this test proves satisfactory it might be advisable to transmit from Yakutsk to Nome, on a point to Point basis, the entire selection of reports scheduled for the Khabarovsk broadcast either in the same cipher, or the one time pads planned for use on the Anadyr-Nome circuit. The Nome-Anadyr circuit was functioning satisfactorily for the exchange of spot weather along the route, but this information in itself is not sufficient for forecast purposes. It is vitally important that at least 45 selected Siberian synoptic reports, plus pilot balloon and meteorograph observations, be received regularly at Nome four times daily. Whether this can be accomplished better by a Yakutsk transmission or relay from Anadyr, is unknown; however it is believed that a point to point type of transmission is necessary for satisfactory reception under adverse radio conditions.

Forecast and other code difficulties in the Anadyr-Nome circuit are being rapidly eliminated. It is felt advisable, and has been requested by the U. S., that the 2 hourly reports be placed on a 24 hour basis on this circuit.

2. Facilities along route:

The weather service within Siberia appeared adequate for ferry operations with the possible exception that reports from a few additional stations east of Semchan would greatly assist the preparation of forecasts along the route.

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Moscow, U.S.S.R.
Sept. 4, 1942

Inclosure No. 1 To Letter From General Bradley To
General Sterligov, Dated September 4, 1942

SANITARY CONDITIONS

1. A marked cleanliness was noted at all our stops about the quarters and room. However the toilets, which consisted of pit-latrines, were very dirty, unprotected from flies, with no evidence of any disinfectant or deodorant being used. Pit-latrines were in use up to and including Omsk. There seemed to be, however, an effort made to keep the latrine itself clean at Omsk.

2. Because of the danger of intestinal diseases, especially, being transmitted by flies, these latrines should be made fly-proof, kept clean at all times, new pits dug when the old pits filled to within two feet of the surface, sprayed with crude oil or lime daily, and be placed not less than 100 yards from the kitchens.

3. A trough urinal should be constructed within the latrines and connected to a urine soakage-pit.

4. No provisions were found at any of the airdromes for bathing. Ordinary hand-basins with running water were non-existent until we reached Omsk. Personal cleanliness will not be maintained by food-handlers and others unless facilities are available.

5. Inspection of meats and dairy products does not exist. The importance of this inspection need not be emphasized, especially in its relation to the feeding and health of any command or community.

6. No screening was noted in any of the dining rooms or kitchens. Flies were a nuisance, as well as a jeopardy to health, at each airdrome. No fly control measures were seen.

7. Water was evidently taken from a nearby river in all instances. On inquiry as to its potability, we were informed that it was filtered in regularly constructed filtration plants before use. As an added protective factor chlorination should be used.

8. No storage plants nor refrigeration plants were seen, although they may have been present at the larger airdromes.

9. Food seemed plentiful, but served in a diet that would not be favorable to American digestion.

10. Waste disposal was very crude. Latrines have already been described. Garbage disposal at one airdrome was taken care of by feeding to pigs. No facilities such as incineration, burial, or garbage stands were in evidence. As to the disposal of liquid wastes no soakage-pits or trenches, grease traps, nor other hygienic methods of disposal were noted.

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11. An epidemiological survey was impossible because of lack of time. Mosquitos were not in evidence to the extent of being a nuisance at least. No mosquito control measures were seen.

12. It would seem probably that lice would be an epidemiological factor to be considered in view of the lack of bathing facilities and long winters. However, no evidence was seen of any steps taken toward the control of lice.

13. Neither was there noted any tendency toward rodent control.

14. On questioning, malaria and typhus, as diseases to be considered as epidemic, were vigorously denied as being prevalent, as was typhoid fever and other intestinal diseases.

15. However at all stops made, these airdromes under their present conditions, sanitary and hygienic, would be fertile soil for the epidemic development of any of the diseases above mentioned, and unless corrective measures are taken, a definite health hazard.

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Moscow, U.S.S.R.
September 4, 1942

Inclosure No. 6 To Letter From General Bradley To General Sterligov, Dated September 4, 1942.

ROUTE CAPACITY (FAIRBANKS TO KRASNOYARSK)

1. Airplanes:

a. Ten C-47 transports to make two round trips per month per airplane, total 20 round trips. Each round trip 55 hours, approximately 110 hours per month per airplane.

b. Each C-47 to carry 26 passengers and crew of four to Fairbanks, Total passengers to Fairbanks, 520 per month.

c. Each C-47 to return with cargo load of 2,500 kilograms (5,500 pounds), or 50,000 kilograms (110,000 pounds) per month.

d. Maximum range of C-47 at long range cruising, 1,500 miles, or 2,500 kilometers.

e. With capacity for 520 passengers delivered to Fairbanks each month would give a daily average of 17 men.

No. of Planes	Types	No. of Crew	Total
12	B-25	4	48
100	A-20	3	300
100	Fighters	1	100
60	" English	1	60
			508 crew men

2. Personnel:

It is estimated that personnel at each stop will be required to service and maintain 10 airplanes daily. Recommend personnel for servicing and maintenance exclusively be distributed as follows:

a. Personnel at Krasnoyarsk - 60 men as follows:

Commanding Officer	-1
Assistants	- 2
Chief Mechanic	- 1
Second Chief Mechanics	- 2
Senior Mechanics	- 2
Mechanics	-16
Mechanics Helpers	-32
Radio Mechanics	- 4
Total	60

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b. Velkal, Semchan, Yakutsk, Kerensk - 30 men as follows:

Commanding Officer	- 1
Assistant	- 1
Chief Mechanic	- 1
Senior Mechanic	- 1
Mechanics	- 8
Mechanics Helpers	- 16
Radio Mechanics	- 2
Total	- 30

3. Equipment:

Each station will require facilities for servicing, heating and dispatching 10 to 18 airplanes daily within a very short period of time with sub-zero temperatures.

4. Fuel and oil required at each stop in Siberia (per month).

Planes will depart with full gas tanks from last stop in Alaska (Nome), arriving at first stop in Siberia with sufficient gas in the tanks to serve as reserve for successive flights. Basic figures:

C-47	0.60	gas gallons per mile
B-25 D	0.63	" " " "
A-20 C	0.55	" " " "
Fighters		
P-39 or 40	0.25	" " " "

Oil requirements is approximately 1.5% of gas.

West bound flights.

Velkal to Semchan - 768 miles

C-47	- 20 trips	(768 x 0.6 x 20)	9,216	gallons
B-25	- 12 "	(768 x 0.63 x 12)	5,806	"
A-20	- 100 "	(768 x 0.55 x 100)	42,240	"
Fighters-	160 "	(768 x 0.25 x 160)	30,720	"
			87,982	

Semchan to Yakutsk - 731 miles

C-47	- 20 trips	(731 x 0.6 x 20)	8,772	gallons
B-25	- 12 "	(731 x 0.63 x 12)	5,526	"
A-20	- 100 "	(731 x 0.55 x 100)	39,200	"
Fighters-	160 "	(731 x 0.25 x 160)	29,120	"
			82,618	"

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Yakutsk to Kerensk - 800 miles

C-47	- 20 trips	(800x0.6 x 20)	9,600 gallons
B-25	- 12 trips	(800 x 0.63 x 12)	6,048 "
A-20	- 100 trips	(800 x 0.55 x 100)	44,000 "
Fighters	- 160 trips	(800 x 0.25 x 160)	32,000 "
			91,648 "

Kerensk - Krasnoyarsk - 582 miles

C-47	- 20 trips	(582 x 0.6 x 20)	6,984 gallons
B-25	- 12 trips	(582 x 0.63 x 12)	4,399 "
A-20	- 100 trips	(582 x 0.55 x 100)	32,010 "
Fighters	- 160 Trips	(582 x 0.25 x 160)	23,280 "
			66,673 "

East bound flights.

C-47 with full gas tanks from Krasnoyarsk.

Kerensk to Yakutsk	- 800 miles	(800 x 0.6 x 20)	9,600 gallons
Yakutsk to Semchan	- 731 "	(731 x 0.6 x 20)	8,772 "
Semchan to Velkal	- 768 "	(768 x 0.6 x 20)	9,216 "
Velkal to Nome	- 514 "	(514 x 0.6 x 20)	6,168 "
			33,756

Resume of gas and oil required.

Velkal	87,982 + 6,168	94,150 gallons	gas
	94,150 x .015	1,412 "	oil
Semchan	82,618 + 9,216	91,834 gallons	gas
	91,834 x .015	1,377 "	oil
Yakutsk	91,648 + 8,772	100,420 gallons	gas
	100,420 x .015	1,506 "	oil
Kerensk	66,673 + 9,600	76,273 gallons	gas
	76,273 x .015	1,144 "	oil

To the above, approximately 10% should be added for test flight, spillage, evaporation, etc.

The main difficulty in the operation of the route between Krasnoyarsk and Velkal, inclusive, will be the supplying of fuel within the required amounts as estimated above. Therefore, every effort should be made to supply said stations during the summer in sufficient quantities to last through the winter months.

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Health Precautions for Siberia
(With particular reference to Area covered by Alaska-Siberian Survey)

1. General. Military personnel and other travellers in this part of the world are exposed to serious health hazards, both because of the presence of diseases not commonly encountered in the United States, and because of the relatively high incidence of certain other diseases that occur in the United States. With the possible exception of some of the larger European Soviet cities, sanitary facilities are few or do not exist. Health conditions are unsatisfactory, and he who values his health must be alert at all times to the possibility of illness, and observe certain necessary hygienic and sanitary precautions. Attention to known health precautions should prevent the acquisition of diseases as well as disability resulting therefrom to personnel ordered to this part of the world.

This discussion covers the hazards of this large general area and not any limited locality. Information acquired locally and from medical officers stationed in this area will modify or dispense with precautions noted in meeting local conditions.

2. Water. Probably the most common source of infection of the intestinal tract comes from water contaminated with fecal matter. These infections include the common diarrheas, typhoid fever, paratyphoid, dysenteries, and cholera. Other conditions such as Guinea-worm infestation and schistonsomiasis result from drinking untreated water. Facilities for the treatment of water were noted in the larger cities such as Omsk. However it is believed that even this equipment is inadequate, and undoubtedly poorly supervised.

For the protection of army or civilian personnel travelling or stationed in this part of the world, it is recommended that all water be considered potentially hazardous for human consumption. It should also be remembered that ice frozen from these waters is also contaminated.

Soft drinks and carbonated drinks are not safe unless known to be prepared under hygienic conditions and pasteurized.

Liquids recommended as safe for human consumption:

a. Boiled water (3-5 minutes).
b. Water properly chlorinated.
c. Tea and coffee, when water is boiled in preparation.
d. Beer and wines when properly prepared and bottled.
e. Fruit juices, undiluted and freshly prepared.

It should also be remembered that water used for washing the teeth or wetting tooth brushes requires the same treatment as drinking water.

3. Foods.

a. General: Foods, in addition to being a source of intestinal disease, are also culture medio for the growth of bacteria. Refrigeration facilities were lacking in the localities surveyed. No inspection of meats was seen, so that meat from animals affected with tuberculosis, undulant fever, trichinosis and other diseases is distributed for human consumption.

Only well-cooked foods, freshly prepared, consumed while hot, and not reheated, are safe for human consumption.

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Exceptions are bread and crackers, which may be considered safe unless mechanically contaminated.

For short missions, sandwiches should not be made before departure. The Army tinned field ration, tinned foods, and crackers or bread should be carried.

b. Milk: Improperly handled dairy products, which include milk, cream, ice crea,, butter, some cheeses, constitute one of the most dangerous groups of foods. From what was seen on this survey all milk products should be considered contaminated in this part of t the world.

Dysentary, cholera, typhoid fever, diarrheas, tuberculosis, undulant fever, septic sore throat, diphtheria, and other infactious diseases, are carried by improperly handled dairy products.

Canned milk, powdered milk prepared with boiled water, or milk boiled immediately before use, can only be considered safe for human consumption.

c. Fruits and Vegetables: Any of the intestinal diseases may be acquired by the consumption of uncooked vegetables, therefore only cooked vegetables should be eaten, unless the source of the uncooked vegetables is known to be satisfactory. Standard items of American diet as salads made of lettuce, other uncooked leafy vegetables, raw carrots and other root vegetables, cannot be eaten with safety.

d. Fish : Sea foods are carriers of parasites such as tapeworms and flukes. Therefore the eating of raw, smoked or undercooked fish should be discouraged. Only thoroughly cooked fish should be eaten.

4. Clothing. Clothing requirements will be similar to those of the northern United States. In some areas the winters will be severe. Study should be made of F. M. 30-15, Operations in Snow and Extreme Cold.

5. Bathing and Swimming. Daily bathing is advisable if possible. Skin folds, such as the crotch, between the toes, arm pits, and groin should be thoroughly cleansed and dried in order to prevent fungus infection such as "dhobie itch".

Lakes and rivers, especially in the populated areas, are undoubtedly contaminated with various fresh water flukes, therefore bathing in these waters is unadvisable. Salt water bathing and swimming present no health hazard except at beaches near the mouths of fresh water streams or near city sewage out-letal

6. Housing. It is wise not to sleep in native quarters. Insects and pests of many descriptions are found, many of them disease-carrying, such as vermin, mosquitoes, fleas, lice, bed-bugs, ticks, and in some localities, scorpions. Troops should maintain their own quarters. Travellers should use hotels if available.

7. Insect Carriers of Disease. There are numerous species of insects, some obnoxious, others carriers of disease, prevalent in this area. The most important are listed below with brief discussions of the dis-

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seases they carry, with applicable precautionary measures:

a. Mosquitoes:

1. Malaria is a dangerous disease and is prevalent in the marshy areas of Siberia. It is spread by the bite of the female anopheline mosquito, many numbers of which are found in this area.

When in these mosquito infected areas mosquito nets should be used, buildings carefully screened, camps should be made far removed from Native villages, mosquito repellents used, insecticides, prophylactic malaria drugs such as quinine and atabrine should be taken when advised by the medical officer.

2. Dengue Fever: Although denied as a disease in this area, it is believed to be present, as quite typical cases have been described clinically. The aedes Aegypti mosquito is the vector, and although dengue is rarely fatal it can be the cause of much disability amongst troops.

3. Filiariasis: Filarial worms can be transmitted by mosquitoes.-Elephantiasis is infrequent among white people, but there is a large Asiatic population and it may be prevalent amongst them.

4. Yellow fever: While no cases have been reported, an infected mosquito may be transported by a plane from an endemic yellow fever area, and become a very serious hazard, because of the fertile community found in some of the areas of Siberia.

b. Lice: Body lice are carriers of the epidemic fora of typhus fever. It is prevalent throughout the area surveyed and is endemic in Moscow as well. Lice also carry the spirochete which causes relapsing fever, as well as the micro-organism that is thought to be the cause of trench-fever.

Prophylactic measures against louse borne diseases are:

1. Frequent bathing.
2. Frequent change into clean clothing.
3. Careful selction of sleeping quarters.
4. Avoidance of native habitations and close contact with louse-infected individuals.
5. Use of insecticide powder on bedding and seams of clothing.
6. In the presence of mass louse infestation, the use of group de-lousing methods.

c. Fleas: At least two serious diseases affecting man, namely, typhus (rat type) and plague, are transmitted by fleas. Fleas found on rats commonly carry these diseases. The finding of dead rats may indicate that these diseases, especially plague, are prevalent. The flease leave the dead rodents, and seek now hosts, including man, thereby trnasmitting typhus and plague to man. Both fleas and rats are prevalent in the inhabited areas of this region.

Plague in humans has been reported in northern China as late as January, 1942, and in the seaports of Japan. With war conditions prevalent, and the region having both fleas and rats, plague should be considered an ever-present possibility.

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d. Ticks: Various species of ticks are found throughout Asia and in Siberia as well. They are responsible for the spread of disease, especially tick-borne relapsing fever.

Precautionary Measures:

1. Avoid native habitations, especially at night when the ticks come out of the walls.

2. Avoid sleeping on the ground, particularly in long grass, or near the trunks of trees.

3. Examine bed for ticks before retiring.

4. Examine skin and clothing for ticks twice daiay. Remove ticks and kill them. Care should be used to prevent the crushing of the ticks as the blood and excreta may cause infection of the various tick-borne diseases. The site of the bite should be cleaned and treated with antiseptic such as iodine or alcohol.

e. Flies: Certain fly-borne diseases are of importance.

1. The Common House Fly: By mechanical means, flies are capable of carrying the causative organisms of the intestinal diseases from the filth and fecal matter to the food of man.

(a) General Precautionary Measures: Destruction of flies and their breeding places.

(b) Use of insect repellents.

(c) Use of nettings or screens.

(d) Protection of foods.

2. Fly-boils: The bites of bot and gadflies may cause abscesses and boils. These flies deposit their maggot-grubs in or on the skin, open wounds, nostrils, or ear canals. These maggots develop, become infected, and boils form. Surgical removal is the only cure.

3. Sand Flies: None were noted but it is believed that they are present in certain areas. Sand flies transmit organisms causing oriental sores as well as sand fly fever.

9. Animals: Diseases Acquired From Animals.

Animals are not only the hosts of insect carriers of disease b ut may also be directly responsible for the spread to man of diseases which these animals themselves contract. The following animale borne diseases are likely to be encountered in this part of the world.

a. Weils Disease: This is an infectious liver disease transmitted in food or water spoiled by the excreta of infected rats. Thus man can contract the disease either by eating or drinking contaminated food or drinks, or by swimming or wading in water contaminated with rat urine or feces.

b. Rabies can be acquired from both wild and domestic animals.

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c. Snake Bite: Information as to the type and prevalence of snakes in this region is not available. Undoubtedly they are present and the types should correspond with those present in northern areas.

10. Venereal Diseases: Venereal diseases are prevalent throughout Asia, and Siberia should be no exception, Soviet health authorities to the contrary notwithstanding. Because of the wide-spread educational program concerning venereal diseases that is being carried on at the present time, and the general knowledge concerning their prevention, further discussion as to prophylaxis, precautionary measures and control will not be discussed at this time.

11. Minor Wounds: Minor wounds should be considered as serious wounds in these areas because of the prevalence of dirt and infection. They should be cleansed immediately with soap and water, and first-aid measures applied; more serious wounds should receive medical attention.

12. Vaccinations: All vaccinations should be completed before departure from the United States. The following vaccinations should be required prior to service in this geographical area:

1. Smallpox
2. Typhoid, paratyphoid
3. Tetanus
4. Yellow fever
5. Cholera
6. Typhus

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Sept. 8, 1942.

Memorandum for: General Bradley.

The following questions are presented as additional information desired of the Alaska-Siberia route.

OPERATIONS

Information on airports east and south of Krasnoyarsk.

Location, size, altitude, facilities available for refueling, maintenance, night operation, radio-meteorology.

Obtain from them a list of airport equipment they wish us to supply — now, and on short order.

Suggest to ascertain from the Soviets what they use in emergency night landing equipment. If considered opportune suggest we offer to them any desired number of Dietz flares (A Dietz flare is a simple container with a wick. The container is filled with kerosene. The flare is hurricane-proof.) Very simple and satisfactory for night take-offs and landings except in vicinity of the enemy since relatively slow in turning on and off. Twenty flares needed for each airport (spaced on each side of the runway).

Information desired as to supplies presently on hand at the airports: Velkal, Markovo, Semcham, Yakutsk, Kirensk, Krasnoyarsk, etc.

Presently on Hand
100 octane gasoline
Aviation summer oil
Aviation winter oil

Due to Arrive Before Start of Winter
100 octane gasoline
aviation summer oil
aviation winter oil

Refueling Facilities at the Airports
Number of refueling trucks
Automotive equipment
Equipment for winter operation
Crash cars — fire extinguishers
Housing, food, medical supplies

SUPPLY

1. Transportation.

a. The routes and means of sending su pplies to the various stations, and the capacity of existing forms of transportation. For example, it is understood that Yakutsk can be supplied by river boat on the Lena River. It would be desirable to know:

(1) How many river boats are available for this purpose?

(2) Their capacity.

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(3) How many tons per month they can transport to the station?

(4) During what period or months they can operate.

b. Similarly it is understood that Yakutsk can be serviced from Neuer on the Siberian railroad, by railroad to Tinda and thence by truck. It would be desirable to know:

(1) The capacity of the rolling stock, in terms of tons per month, into Neuer and Tinda.

(2) The number of trucks available on the route, and their capacity.

(3) The number of months per year that these routes can be operated.

c. Information ports on the Arctic Sea, boats and unloading facilities available, and months of the year they can operate.

d. Any roads or railroads under construction which will be useful in servicing the stations.

2. Communications.

a. What facilities, other than radio, are available for requesting supplies. (It is understood Yakutsk had telephone and telegraph to Ikkutsk.

3. Fuel and Oil.

a. Capacity for bulk storage of fuel and oil at each station.

b. Quantity of bulk fuel and oil stored at station, octane rating of fuel, and grades or viscocities of oil.

c. Quantity of fuel and oil stored in drums at station.

d. Amount or rate that fuel and oil can be transported to the station monthly, weekly, or periodically.

e. Number and capacity of fuel and oil servicing trucks on hand and contemplated.

4. Power.

While it is understood that power throughout the area is 220 volt, 3 phase, 60 cycle, it would be desirable to have this verified and determine the number of kilowatts available to the AAF. This would permit sending auxiliary units in the event power supply is insufficient.

5. Buildings.

a. How many square feet of:

(1) Warehouse space,
(2) Hangar space,
(3) Shops,

will be made available at each station? If this contemplated construction, when will it be completed?

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6. What equipment will be available at each station for winter operation?

7. Fuel for Heating.
It was observed that wood was used generally for heating. It would be desirable to know what quantities (cubic feet or meters) would be made available. In the event this was insufficient power equipment would have to be brought in to make U.S. personnel self-sufficient.

8. How long would it take to build living accommodations at each station for:

a. 25 people,

b. 50 people,

c. 100 people,

d. 200 people,

or any desired number.

MEDICAL

General.

1. Electric power — type of current. Is it standardized?

2. Any movement of population into areas from other regions of the Soviet that might involve a health problem?

3. Public Health organization. How does it function?

4. Are vital statistics available for these areas?

5. Are any diseases considered to be of important endemically or epidemically?

6. In the event American forces or personnel were to operate their own medical facilities, would permanent buildings with utilities be available?

7. Are medical supplies and equipment obtainable locally?

8. Can any appreciable amount of food and dairy products be purchased locally?

9. Are any further sanitary projects such as water and sewage facilities contemplated at the various airdromes?

COMMUNICATIONS

Stations:.....
Location of Station .....
Call Letters .....

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Hours of Operation:
  Point to Point.....
  Aeronautical.....
  Weather .....
  Others .....

Transmitting Equipment Number Power Type Freq. Range Use
.....
.....
.....
.....
.....
.....

Receiving Equipment: Number Type Freq. Range Use
.....
.....
.....
.....
.....
.....

Antennas: Type Direction
.....
.....
.....
.....

Radio Range: Power Identification Frequency Frequency guarded
.....
.....

Direction Finding Facilities: Call sign Trans. Freq. Rec. Freq.
  High Frequency .....
  Low Frequency .....
  Others .....

Power: Capacity Phase AC or DC Voltage Type
  City .....
  Auxiliary .....

Personnel: Radio operators Radio technicians Service-men
.....

WEATHER

1. Information as desired by weather officer is being furnished satisfactorily.

A. L. Harvey
Colonel, AAF

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Major General Bradley, USA

Dear General Bradley:

The following are in reply to the questions which you addressed to me on September 14, 1942:

1. My government has granted permission for the flight of Colonel Harvey's group to proceed to Alaska without exit visas.

2. As to the question of permitting Colonel Harvey to make a detailed inspection of the means available for servicing at the airfields en route, I am not quite clear as to the purpose of such an inspection since the planes accepted by us in Alaska will be flown by our crews and also since the recent survey by Colonel Harvey's group proved that it is feasible to fly planes over this route in its present state. It appears to me that there is no necessity for the requested inspection.

3. Work on the Velkal airfield is nearing completion and the question of providing fuel and oil for this airfield is taken care of.

4. Not one of the allotted planes has yet flown out of Alaska as none of our crews designated to fly them have yet arrived. Weather conditions are still hampering the arrival of these crews.

5. I reported to the Chief of the Red Army Air Force the condolences of General Arnold which were transmitted

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by you concerning the death of the Soviet crew in Basra. The chief wishes to convey his gratitude to General Arnold for his sympathy.

Sincerely,

Major General of Aviation,

Sterligov

September 17, 1942.

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WAR DEPARTMENT
HEADQUARTERS OF THE ARMY AIR FORCES
WASHINGTON, D. C.

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Col Harvey's Report
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SAFETY FILM KODAK

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MARKOVA

Latitude 64° 45'N
Longitude 171° E
altitude 25 M
Runway one
Direction E-W
Surface Black loam, rolled graded
Dimensions 1000 M X 50 M
Expansion Possibilities unlimited
Markings none
Lighting facilities none
Approaches good
fuel and oil (reported available)
Means of supplies (Anadyr River)
Hangar none
Shops none
Meteorological service, available
Radio yes
accomodations and food (food limited, quarters being built).

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WAR DEPARTMENT
WASHINGTON, D. C.

Berelech

~~Berelech~~ (approx 200 km [redacted] Seimelan)

Latitude: 60° 45' N
Longitude 147° 10' E
Altitude 635 m

Runway — one
Direction NNE (mag)
Dimensions 1000 m X 100 m
Surface — rocky loam rolled - graded
Drainage — good - natural
Expansion possibilities — good
Windsock — yes
Markings — none (except wooden runway marker)
Lighting facilities — none permanent
Approaches — good (but field is surrounded by mountains up to 2000 m high)
Fuel and oil — available (limited)
Means of furnishing supplies — ~~road air~~ water
Hangars - none
Ships - none
Meteorological service — available good
Radio
Accommodations and food — yes satisfactory for limited number of men (30)

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2. Airports.

Markovo
Semchan:

Latitude:		62° 52' N.
Longitude:	-	152° 26' E.
Altitude:	-	170 M., 2 km. SW of village.
Runway:	-	one (not paved)
"	-	direction N-S
Dimensions:	-	1,200 M. x 100 M. (being enlarged to 300 meters)
Surface:	-	rocky loam, natural and graded.
Drainage:	-	wooden rectangular drainpipes, according to local advice satisfactory.
Expansion possibilities	-	good.
Windsock:	-	yes.
Markings:	-	none, except wooden markers for runway.
Lighting facilities:	-	none permanent.
Approaches:	-	good.
Fuel and oil:	-	available.
Means of furnishing supplies:	-	Road river boats and air.
Hangars:	-	none.
Shops:	-	none.
Meteorological service:	-	available (good).
Accommodations and food:	-	satisfactory for limited number of men (50).

Borulch

Yakutsk:

Latitude:	-	62° N.
Longitude:	-	129° 40' E.
Altitude:	-	320 M. 8 km. N. of town.
Runways:	-	three (not paved).
Dimensions:		Direction In Degrees Approximately:
1,400 x 100 M.	-	10°
1,600 x 100 M.	-	45°
1,200 x 100 M.	-	120°
Surface:	-	sandy loam - natural.
Drainage:	-	good - natural.
Expansion possibilities:	-	good.
Windsocks:	-	yes.
Markings:	-	wooden markings on runway, otherwise none.
Light facilities:	-	none permanent.
Approaches:	-	good.
Fuel and oil:	-	available.
Hangars:	-	none.
Shops:	-	none.
Meteorological service:	-	available, good.
Accommodations and food:	-	satisfactory for limited number of men (100).
Means for furnishing supplies:	-	river boat, road and air.

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Yeremsk:

Latitude:	-	58° 30' N.
Longitude:	-	108° 10' E.
Altitude:	-	400 M. (approx.) 2 km. W. of village.
Runway:	-	one, not paved.
Dimensions:	-	1,200 x 100 M. Direction E-W.
Surface:	-	sandy loam, natural.
Drainage:	-	satisfactory.
Expansion possibilities:	-	good.
Windsock:	-	yes.
Markings:	-	wooden runway markings, otherwise none.
Light facilities:	-	none permanent.
Approaches:	-	good.
Hangars:	-	none.
Shops:	-	none.
Meteorological service:	-	available.
Accommodations and food:	-	satisfactory for limited number of men (approximately 20).
Means of furnishing supplies:	-	river boat and air.

Krasnoyarsk:

Latitude:	-	56° 05' N.
Longitude:	-	92° 50' E.
Altitude:	-	160 M.
Runways:	-	two - paved - concrete.
Dimensions:	-	1,100 x 100 M. (plus 100 M. narrow extension, concrete taxi strips and parking areas.)(The field, approximately 1 mile square, available for light planes.)
Surface:	-	sandy loam.
Drainage:	-	good.
Expansion possibilities:	-	good.
Windsock:	-	yes.
Markings:	-	yes.
Lighting facilities:	-	none permanent (runway lights).
Approaches:	-	good.
Fuel and oil:	-	available.
Hangars:	-	four (medium size) wood construction.
Shops:	-	in town.
Meteorological service:	-	available - good.
Accommodations and food:	-	satisfactory for larger number of men (200).
Means of furnishing supplies:	-	river boat, railroad and air.

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3. Route.

Nome - Anadyr: - Across Bering Straits and Gulf of Anadyr, skirting the southern shores of Cape Chaplin, which are rocky, barren cliffs. Hardly any population.

Anadyr - Markovo: - Across land consisting of low, swampy tundra with occasional sparsely wooded rolling hills. Extremely sparsely populated.

Markovo - Semchan: - Rolling wooded hills changing to mountainous country. Pine and spruce forests. Elevation gradually increasing to approximately 6,000 feet. Extremely sparsely populated.

Semchan - Yakutsk: - Continuing mountainous country with elevations increasing to approximately 11,000 feet, and descending to the plains east of Yakutsk. Extremely sparsely populated.

Yakutsk - Krasnoyarsk: - Low rolling wooded country with frequent areas of tundra. Very sparsely populated.

Krasnoyarsk - Urals: - Low flat country gradually becoming more cultivated and populated approaching the Urals.

Urals - Moscow: - Low rolling country, with forests, intensively cultivated and more populated.

The country east of Krasnoyarsk and particularly east of Yakutsk offers hardly any natural open landing grounds. The low flat lands are swampy tundra and all higher dry land is wooded and mostly uneven. In winter, of course, landings may be made on frozen rivers, lakes and tundras if the snow conditions permit.

4. The route as at present (assuming that the airport and refueling facilities are available at Velkal) will have airports at intervals not exceeding 1,300 kilometers (800 miles), and is flyable with reasonable safety factor by aircraft having a cruising range of approximately 2,000 kilometers (1,250 miles).

The meteorological and radio communications and navigation facilities appear to be satisfactory, which is substantiated by the fact that the Russian crews of the B-25 and DC-3 of the survey party negotiated the route without any difficulty under relatively adverse weather conditions.

5. Recommendations for improving the present Moscow - Nome route:

Airports: - Approximately every 800 kilometers (500 miles) it is desirable to have a first-class airport consisting of:

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Paved runways: - One to three, depending upon wind conditions. One runway - 1,600 M. x 100 M. The others approximately 1,300 M. x 100 M.

Good approaches: - Night landing facilities, All necessary facilities for refueling and maintaining aircraft - for year round operation.

Complete radio communications and radio navigation facilities.
Complete meteorological facilities.

First-class airports would be required at least in:

Vicinity of Anadyr
Semchan
Yakutsk
Kerensk
Krasnoyarsk
Novosibirsk
Omsk
Sverdlovsk
Kazan
Moscow

In between the first-class airports at intervals of approximately every 400 kilometers (250 miles) it is desirable to have second-class airports (auxiliary) consisting of:

Runways: - One to three depending upon wind conditions. One runway 1,100 M. (3,600 ft.). The others approximately 1,000 M. (3,280 feet).

Good approaches:
Night Landing Facilities:
Maintenance Facilities:
Radio Facilities:
Meteorological Facilities:

The selection of sites for auxiliary airports should be made as soon as possible and work on airports started in order to take advantage of the winter months, at which time it will be possible to haul construction men and supplies by planes equipped with skis. This is particularly advisable for the airport sites east of Yakutsk which are mostly inaccessible except by air. The airport sites should be selected preferably alongside of rivers or lakes which can be used as landing fields when frozen.

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Suggested basic figures for estimates:

Planes: - Transports (Douglas DC-3) 240 k.p.h. (150 m.p.h.)
Light bombers, pursuits 280 " " " (175 " " ")
Transport planes - 4 hrs. per day - 120 hrs. per month.

Remarks: - 4 hours per day per plane is relatively low; however, in view of limited night operation and difficult weather this estimate will be hardly exceeded.

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Itinerary of the Return Trip from Moscow to Fairbanks, Alaska

September 19, 1942
Moscow 8:20
Svervlovsk 13:30
Elapsed time 5 Hrs. 10 Min.

September 20
Svervlovsk 6:20
Omnsk 9:30
Elapsed time 3 Hrs. 10 Min.
Omnsk 10:35
Krasnoyarsk 15:20
Elapsed time 4 Hrs. 45 Min.

September 21
Krasnoyarsk 6:10
Krasnoyarsk 6:25
(Returned because of loose propeller spinner)
Krasnoyarsk 6:35
Kerensk 10:20
Elapsed time 3 Hrs. 45 Min.

September 23
Kerensk 8:30
Yakutsk 14:35
Elapsed time 6 Hrs. 5 Min.

September 24
Yakutsk 12:10
Berelok 16:05
Elapsed time 3 Hrs. 55 Min.

September 25
Berelok 14:55
Seimchan 16:05
Elapsed time 1 Hr. 10 Min.

October 2
Seimchan 10:15
Markovo 14:10
Elapsed time 3 Hrs. 55 Min.

October 3
Markovo 10:05
October 2*
Nome 15:15
Elapsed time 5 Hrs. 10 Min.

*International Date Line

October 3
Nome 8:55
Fairbanks 12:15
Elapsed time 3 Hrs. 20 Min.

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MARKOVO

Latitude - 64°45' N.
Longitude - 170°20' E.
Altitude - 10 m.
Runway - One, approximately NNE Mag.
Dimensions - 1,000 m. x 100 m.
Surface - ~~Pisaki, Sod~~ levelled, gravel
Drainage - Good
Expansion Possibilities - Limited to approximately 1300 m.
Wind-sock - Yes
Markings - None, except wooden runway markers
Lighting Facilities - None permanent
Approaches - Good
Fuel and Oil - Available but limited
Means of Furnishing Supplies - By riverboat and air
Hangars - None
Shops - None
Meteorological Service - Available, Radio available
Accommodations in Food - Satisfactory for a limited number of men (50)

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VELKAL

Latitude - 65°35' N
Longitude - 180°25' E
Altitude - 10 m.

This airport was not visited by survey party and, therefore, no further details are available. However, according to information received from the Russian Officers, this airport is satisfactory for aircraft of Douglas DC-3 type.

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THE JOINT BOARD
Joint Planning Committee
Washington

J.B. No. 312
(Serial 718)

November 24, 1941.

S E C R E T

From: The Joint Planning Committee.

To: The Joint Board.

Subject: Construction of airdromes in the Aleutian Islands and the Alaskan Peninsula.

References:
(a) J.B. No. 312 (Serial 650) of 14 August, 1940.
(b) J.B. No. 312 (Serial 718) of 12 August, 1941.
(c) Report of The Joint Planning Committee, September 3, 1941, on J.B. No. 312 (Serial 718).
(d) WD letter, September 24, 1941, AG 600.12 (9-23-41)MC-E to the Chief of Engineers.
(e) Report of the District Engineer, Seattle, Wash., on landing field sites Umnak Island and Unalaska.

Enclosures:
(A) Copy of CG, Fourth Army letter of 2 June, 1941.
(B) Copy of CG, Fourth Army letter of 23 July, 1941.

Section I - The Directive.

1. Reference (b) referred to The Joint Planning Committee for appropriate action a letter from The Chief of Naval Operations concerning the proposed construction by the Army of a pursuit airdrome at Umnak Island and by the Civil Aeronautics Administration of staging fields at Port Heiden, Cold Bay and Stepovak Bay, and which requested that base construction projects dependent on water transportation be referred to The Joint Board.

2. The matters to be determined are considered to be:

(a) Whether or not the proposed airdrome system should be constructed at this time.

(b) Whether or not such projects should be agreed upon by The Joint Board.

3. Consideration of reference (c) was suspended by The Joint Board at its meeting on September 19, 1941, pending a reconnaissance of Unalaska and Umnak Island to determine the following information:

(a) The possibility of developing an airfield on Unalaska. If construction is considered possible, to prepare at estimate of the costs and time involved together with an analysis of the weather conditions affecting aircraft operations therefrom.

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(b) The possibility of developing an airfield on Umnak Island. If construction is considered possible, to prepare an estimate of the costs and time involved, together with an analysis of weather conditions affecting aircraft operations therefrom.

(c) The harbor facilities required at Umnak Island to supply, by water transport, a force of approximately 2600 troops, together with an estimate of costs and time involved for such construction.

4. In reference (d) the War Department directed the Chief of Engineers in collaboration with the Chief of Army Air Forces to institute the survey of Unalaska and Umnak Island directed by The Joint Board.

5. This report supercedes reference (c) which is hereby withdrawn.

Section II - Discussion.

6. Reference (a) placed on the Army the responsibility for the defense of naval bases in Alaska, including Unalaska, and required that local commanders investigate and report on the practicability and need for a field on Unalaska.

7. The Commanding General, Fourth Army, has submitted to the War Department recommendations for the establishment of the following:

(a) At Otter Point, Umnak Island
(1) An airdrome suitable for the use of both pursuit and bombardment aviation.
(2) A garrison consisting of:

1 Infantry battalion reinforced
1 AA battalion
1 155 mm gun battery
1 Squadron pursuit
Service detachments.
Total: 122 officers; 2,455 enlisted men.

(b) At Cold Bay, Alaskan Peninsula
(1) A staging field for all types of aircraft.
(2) A garrison consisting of:

1 Infantry battalion reinforced, less two companies
1 AA gun battery
1 AA composite battery
1 155 mm gun battery
Service detachments.
Total: 54 officers; 1,344 enlisted men.

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(c) At Port Heiden, Alaskan Peninsula
(1) A Staging field for all types of aircraft.
(2) A garrison consisting of:
1 Infantry company less 1 rifle platoon
plus one machine gun platoon
Service detachments.
Total: 10 officers; 258 enlisted men.

8. The survey of Unalaska and Umnak Island directed by The Joint Board indicates the following:

(a) The practical impossibility of constructing an all purpose airfield on Unalaska, regardless of costs.

(b) Umnak Island affords a natural site for the construction of an all purpose airfield with adequate provision for expansion. Temporary runways suitable for the operation of bombardment and pursuit aircraft can be completed within six months from the initiation of construction. One paved runway can be completed within nine months from date construction is started and the second and third runways, two and four months later. Housing can be provided for a garrison of 2600 officers and men within nine months after initiation of the project. Flying conditions at the site are only fair, but better than other locations in the general area. The entire region of the chain of Aleutian Islands is subject to occasional high winds and sudden storms. However, extremely cold weather is never encountered, ten degrees above zero being the lowest recorded during a ten year period at Dutch Harbor. Foggy weather is not uncommon.

(c) A deep water dock at the Otter Point site, protected from the northeast storms (the most severe in this area) can be provided by constructing a jetty extending out about half the distance from Pustoi Point to Pustoi Island and a shorter jetty to the south of the dock. This development can be accomplished for approximately $2,000,000. Its advantages are that all activities would be concentrated near the site and the initial installation forms part of an ultimate plan that could be expanded to provide complete harbor facilities at a later date by extending the two jetties, if required. Its disadvantages are that of initial cost and the fact that during the rare occasions of southerly winds of gale force, the harbor could not be used. At such times, ships would have to find refuge in Chernofski Bay (11 miles distant) until conditions improve. However, it is believed that periods when this condition would be encountered would occur infrequently and then would be of only a very few days' duration.

9. The 807th Engineers now at Yakutat is available for transfer for employment at Umnak. Construction can be initiated at any season of the year. The equipment and operators required for construction are largely available for transfer from other projects in Alaska under the supervision of the District Engineer, on which

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construction is well advanced. There will be little delay incident to the procurement of construction equipment.

10. The following is an estimate of the total cost of the entire project, based on an actual engineering survey:

(a) Runways and appurtenant facilities,	$4,406,000
(b) Cantonment and appurtenant facilities,	$5,509,000
(c) Harbor facilities	1,940,000
(d) Mobilization and Demobilization	750,000
Total	$12,605,000

11. The establishment of the proposed airdrome system will have the following advantages:

(a) It will provide a means for operating shore-based bombardment aviation against objectives within the radius of action of the airdromes concerned.

(b) It will provide a means for operating pursuit aviation in defense of other installations in the same area, although the effectiveness of the pursuit aviation defense of Dutch Harbor will be limited by the distance from Otter Point, 65 miles, and by the weather which prevails in the Aleutians.

(c) It will provide a means for preventing hostile seizure of Umnak Island and its potential airdrome site.

12. The establishment of this airdrome system will have the following disadvantages:

(a) It will necessitate the creation of an adequate local defense of each airdrome, which in the case of Umnak should include a permanent air component.

(b) It will create a requirement for shipping for the initial construction of the airdromes and their ground defenses and for their subsequent logistic support.

(c) It will create requirements for naval protection of the sea communications of the three developments.

13. The Army estimates that it will have sufficient air forces available for the profitable use and for the defense of the Umnak airdrome by September 1, 1942.

14. At the present time, the requirements for shipping in connection with development of bases in the Pacific are increasing. These bases include not only those in the Hawaiian Islands and the Far East, but also the island air bases of which the early completion is needed to permit rapid movement of Army aircraft to the Far East. These island air bases now include Midway, Wake, Palmyra, Canton and Samoa plus possible future developments between Wake Island and the Philippines and between Samoa and Australia.

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15. The extent of existing commitments with respect to development of bases outside the United States for purposes of defense of the western hemisphere, and of air bases to permit rapid movement of aircraft to the British Isles, to the Middle East via South America and West Africa, and to the Far East via the Pacific Islands, render it necessary that new projects of major importance which affect both services be reviewed from a broad point of view in the light of the major problems confronting both services. Such a review can best be ensued by referring them to The Joint Board. Once basic decisions have been made by The Joint Board, details of such projects should be handled by normal administrative agencies within the two services.

Section III - Recommendations.

16. It is recommended that:

(a) The War Department proceed with the construction of port facilities, airdromes and defenses at Umnak, Port Heiden, and Cold Bay on the scale of those recommended by the Commanding General, Fourth Army.

(b) The construction of airdromes in the Alaskan Peninsula and the Aleutians be not allowed to interfere with completing the landplane route to the Far East.

(c) Development projects of strategic importance which affect both services be referred to The Joint Board for basic decisions only, and that details be left to normal administrative agencies.

L. T. GEROW,
Brigadier General, U.S. Army.

R. I. TURNER,
Rear Admiral, U.S. Navy.

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THE JOINT BOARD
Joint Planning Committee
Washington

J.B. No. 312
(Serial 718)

November , 1941.

S E C R E T

From: The Joint Planning Committee.

To: The Joint Board.

Subject: Construction of airdromes in the Aleutian Islands and the Alaskan Peninsula.

References:
(a) J.B. No. 312 (Serial 650) of 14 August, 1940.
(b) J.B. No. 312 (Serial 718) of 12 August, 1941.
(c) Report of the Joint Planning Committee, September 3, 1941, on J.B. No. 312 (718).
(d) WD letter, September 24, 1941, AG 600.12 (9-23-41) MC-E to the Chief of Engineers.
(e) Report of the District Engineer, Seattle, Wash., on landing field sites Unmak Island and Unalaska.

Enclosures: (A) Copy of Reference (d).

1. In reference (c) The Joint Planning Committee recommended to The Joint Board that:

(a) The War Department proceed with the construction of port facilities, airdromes and defenses at Unmak, Port Heiden, and Cold Bay on the scale of those recommended by the Commanding General, Fourth Army.

(b) The construction of airdromes in the Alaskan Peninsula and the Aleutians be not allowed to interfere with completing the landplane route to the Far East.

(c) Development projects of strategic importance which affect both services be referred to The Joint Board for basic decisions only, and that details be left to normal administrative agencies.

2. These recommendations were taken under advisement by The Joint Board at its meeting on September 19, 1941. The discussion resolved into a consideration of establishing an Army Airfield on Unmak Island. The Navy members made the following points with reference to the inadvisability of an airfield on Umnak Island:

(a). Great difficulty in maintaining sea communications with Umnak would be experienced without adequate harbor development and protection.

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(b) The excessive cost of putting in adequate harbor developments, the money for which, they believed, might better be spent in developing an air field at Unalaska.

(c) The difficulty of employing pursuit aviation in protection of the Dutch Harbor installations from Umnak, a location some 65 miles away from the area to be protected, particularly in view of the fact that hostile carrier-borne aviation might approach Dutch Harbor from some direction other than the west.

At the request of the Army members, action on this subject was suspended until reconnaissance could be made and further information obtained.

3. In reference (d) the War Department directed the Chief of Engineers in collaboration with the Chief of Army Air Forces to institute such survey of Unalaska and Umnak Island as would be required to determine the following information:

(a) The possibility of developing an airfield on Unalaska. If construction is considered possible, to prepare an estimate of the costs and time involved together with an analysis of the weather conditions affecting aircraft operations therefrom.

(b) The possibility of developing an airfield on Umnak Island. If construction is considered possible, to prepare an estimate of the costs and time involved, together with an analysis of weather conditions affecting aircraft operations therefrom.

(c) The harbor facilities required at Umnak Island to supply, by water transport, a force of approximately 2500 troops, together with an estimate of costs and time involved for such construction.

4. The results of this survey indicate the following:

(a) The practical impossibility of constructing an all purpose airfield on Unalaska, regardless of costs.

(b) Umnak Island affords a natural site for the construction of an all purpose airfield with adequate provision for expansion. That temporary runways suitable for the operation of bombardment and pursuit aircraft can be completed within six months from the initiation of construction. One paved runway can be completed within nine months from date construction is started and the second and third runways, two and four months later. Housing can be provided for a garrison of 2600 officers and men within nine months after initiation of the project. Flying conditions at the site are fair, but better than other locations in the general area. The entire region of the chain of Aleutian Islands is subject to occasional high winds and sudden storms. However, extremely cold weather is never encountered, ten degrees above zero being the lowest recorded during a ten year period at Dutch Harbor. Foggy weather is not uncommon.

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(c) A deep water dock at the Otter Point site, protected from the northeast storms (the most severe in this area) can be provided by constructing a jetty extending out about half the distance from Pustoi Point to Pustoi Island and a shorter jetty to the south of the dock. This development can be accomplished for approximately $2,000,000. Its advantages are that all activities would be concentrated near the site and the initial installation forms part of an ultimate plan that could be expanded to provide complete harbor facilities at a later date, by extending the two jetties, if required. its disadvantages are that of initial cost and the fact that during the rare occasions of southerly winds of gale force, the harbor could not be used. At such times, ships would have to find refuge in Chernofski Bay until conditions improve. However, it is believed that periods when this condition would be encountered would occur infrequently and then would be of only a very few days' duration.

5. The 807th Engineers now at Yakutut are available for transfer for employment at Umnak. Construction can be initiated at any season of the year. The equipment and operators required for construction are largely available for transfer from other projects in Alaska under the supervision of the District Engineer, on which construction is well advanced. There will be little delay incident to the procurement of construction equipment.

6. The following is an estimate of the total cost of the entire project, based on an actual engineering survey:

(a)	Runways and appurtenant facilities -	$4,406,000
(b)	Cantonment and appurtenant facilities -	$5,509,000
(c)	Harbor facilities -	1,940,000
(d)	Mobilization and Demobilization -	750,000
	TOTAL	$ 12,605,000

7. The advantages accruing from the development have been set forth in a prior Joint Board proceeding.

8. Due to the potential threat to the security of Alaska which Umnak Island affords, if seized by an enemy, ~~the War Department proposes to~~ the CG Western Command has recommended the garrison the island with defense forces, whether or not an air field is constructed. The Infantry element of the ground troops to

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compose the garrison (one battalion of Infantry reinforced) is immediately available from the Army forces in Alaska, for movement to the site.

9. Consideration of the development of an airfield in this area has been studied, examined and investigated for a period of over one year. During this time, the need for this facility has become more apparent. In view of the War Department's intention to garrison the island in any event from troops already in Alaska, it is believed that the demands for additional shipping created by this project will be little if any more than that required for routine supply of the Alaska Defense Command. Moreover, naval protection of the sea communications must be provided to Dutch Harbor. The development of Umnak will require only that the existing patrol be extended sixty-five (65) miles. It does not create additional requirements. The security of sea communications to Port Heiden and Cold Bay are incidental to that now existing for Dutch Harbor.

Section III- Recommendations.

10. It is recommended that the War Department proceed with the construction of port facilities, air fields and defenses at Umnak Island, Port Heiden and Cold Bay as previously recommended.

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THE JOINT BOARD
Joint Planning Committee
Washington

Revised by copy Nov 24

J.B. No. 312
(Serial 718)

September 3, 1941.

SECRET

From: The Joint Planning Committee.

To: The Joint Board.

Subject: Construction of airdromes in the Aleutian Islands and the Alaskan Peninsula.

References: (a) J.B. No. 312 (Serial 650) of 14 August, 1940.
(b) J.B. No. 312 (Serial 718) of 12 August, 1941.

Enclosures: (A) Copy of CG, Fourth Army letter of 2 June, 1941.
(B) Copy of CG, Fourth Army letter of 23 July, 1941.

Section I - The Directive.

1. Reference (b) referred to The Joint Planning Committee for appropriate action a letter from The Chief of Naval Operations concerning the proposed construction by the Army of a pursuit airdrome at Umnak Island and by the Civil Aeronautics Administration of staging fields at Port Heiden, Cold Bay and Stepovak Bay, and which requested that base construction projects dependent on water transportation be referred to The Joint Board.

2. The matters to be determined are considered to be:

(a) Whether or not the proposed airdrome system should be constructed at this time.

(b) Whether or not such projects should be agreed upon by The Joint Board.

Section II - Discussion.

3. Reference (a) placed on the Army the responsibility for the defense of naval bases in Alaska, including Unalaska, and required that local commanders investigate and report on the practicability and need for a field on Unalaska.

4. The Commanding General, Fourth Army, has submitted to the War Department recommendations for the establishment of the following:

(a) At Otter Point, Umnak Island

(1) An airdrome suitable for the use of both pursuit and bombardment aviation.

(2) A garrison consisting of:

1 Infantry battalion reinforced
1 AA battalion
1 155 mm gun battery
1 Squadron pursuit
Service detachments.
Total: 122 officers; 2,455 enlisted men.

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(b) At Cold Bay, Alaskan Peninsula
(1) A staging field for all types of aircraft.
(2) A garrison consisting of:

1 Infantry battalion reinforced, less two companies
1 AA gun battery
1 AA composite battery
1 155 mm gun battery
Service detachments.
Total: 54 officers; 1,344 enlisted men.

(c) At Port Heiden, Alaskan Peninsula
(1) A staging field for all types of aircraft.
(2) A garrison consisting of:
1 Infantry company less 1 rifle platoon plus one machine gun platoon
Service detachments.
Total: 10 officers; 258 enlisted men.

5. The proposed Otter Point airdrome site is located on Umnak Island on the northwest shore of Umnak Pass. Strong winds and heavy storms frequently occur in this region, and strong currents run through Umnak Pass. The only anchorage available for ships carrying supplies and equipment is in Otter Bay, which is an open bight which affords some shelter from northerly, westerly and southerly winds, but which is open to the east.

6. The Commandant, Thirteenth Naval District, reported on August 22, 1941 that:

"The harbor development required to make it a safe and adequate harbor is considerably beyond what is believed to be possible. A breakwater affording complete shelter both from the weather and from submarine attack would probably be prohibitive in cost, construction difficulties and time required. It is uncertain whether a pier could be constructed adequate to take cargo vessels, or whether it could stand up under heavy north-easterly weather.

"It is believed that construction of an airfield here would have to be carried out on an 'opportunity' basis, that is, anchoring cargo vessels and lightering cargo ashore during favorable weather, but discontinuing and running for shelter when conditions became unfavorable."

7. The establishment of the proposed airdrome system will have the following advantages:

(a) It will provide a means for operating shore-based bombardment aviation against objectives within the radius of action of the airdromes concerned.

(b) It will provide a means for operating pursuit aviation in defense of other installations in the same area, although the effectiveness of the pursuit aviation defense of Dutch Harbor will be limited by the distance from Otter Point, 65 miles, and by the weather which prevails in the Aleutians.

(c) It will provide a means for preventing hostile seizure of Umnak Island and its potential airdrome site.

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8. The establishment of this airdrome system will have the following disadvantages:

(a) It will necessitate the creation of an adequate local defense of each airdrome, which in the case of Umnak should include a permanent air component.
(b) It will create a requirement for shipping for the initial construction of the airdromes and their ground defenses and for their subsequent logistic support.
(c) It will create requirements for naval protection of the sea communications of the three developments.
(d) It will necessitate construction of harbor facilities at great expense and difficulty, unless lightering is to be used permanently.

9. The Army estimates that it will have sufficient air forces available for the profitable use and for the defense of the Umnak airdrome by September 1, 1942.

10. At the present time, the requirements for shipping in connection with development of bases in the Pacific are increasing. These bases include not only those in the Hawaiian Islands and the Far East, but also the island air bases of which the early completion is needed to permit rapid movement of Army aircraft to the Far East. These island air bases now include Midway, Wake, Palmyra, Canton and Samoa plus possible future developments between Wake Island and the Philippines and between Samoa and Australia.

11. The extent of existing commitments with respect to development of bases outside the United States for purposes of defense of the western hemisphere, and of air bases to permit rapid movement of aircraft to the British Isles, to the Middle East via South America and West Africa, and to the Far East via the Pacific Islands, render it necessary that new projects of major importance which affect both services be reviewed from a broad point of view in the light of the major problems confronting both services. Such a review can best be ensued by referring them to The Joint Board. Once basic decisions have been made by The Joint Board, details of such projects should be handled by normal administrative agencies within the two services.

Section III - Recommendations.

12. It is recommended that:

(a) The War Department proceed with the construction of port facilities, airdromes and defenses at Umnak, Port Heiden, and Cold Bay on the scale of those recommended by the Commanding General, Fourth Army.
(b) The construction of airdromes in the Alaskan Peninsula and the Aleutians be not allowed to interfere with completing the landplane route to the Far East.
(c) Development projects of strategic importance which affect both services be referred to The Joint Board for basic decisions only, and that details be left to normal administrative agencies.

(Sgd) L. T. Gerow
L. T. GEROW,
Brigadier General, U.S. Army.

(Sgd) R. K. Turner
R. K. TURNER,
Rear Admiral, U.S. Navy.

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J.B. No. 312
(Serial 718)

SECRET

HEADQUARTERS FOURTH ARMY
Office of the Commanding General
Presidio of San Francisco, California JLD/tgb

381 Dutch Harbor (G-4) June 2, 1941

Subject: Air Defense of Naval Base at Dutch Harbor.

To : The Chief of Staff, U.S. Army
Washington, D.C.

1. Reference is made to your secret radio of April 26, 1941, to the undersigned, on the subject of an air field in the vicinity of Dutch Harbor and one between Kodiak and Dutch Harbor, (copy enclosed).

2. After a thorough study of this problem and reconnaissance of possible areas by members of my staff, and after personal study of the area in question between May 17 and 23, accompanied by the Commanding General, Alaska Defense Command, I am impelled to reaffirm the recommendations made in the third indorsement, this headquarters, January 16, 1941, on 381/15 - "Alaska, Defense of."

3. The additional fields recommended in that communication are essential in order to accomplish the Army's mission of defending the Naval Base at Dutch Harbor and the Alaskan territory.

4. Unless these fields are provided:-

a. The Army will have to admit it cannot accomplish its assigned mission.
b. The Navy will have to make provision for its own defense in that locality.
c. An emergency landing field on the island of Umnak (65 miles west of Dutch Harbor), will offer a definite threat to the Naval Base at Dutch Harbor unless steps are taken to establish a field there or to deny its use to an enemy.

5. The mission of the Alaska Defense Command is:-

"To defend United States military and naval installations in Alaska, including Unalaska, against sea, land, and air attacks, and against sabotage.
"To deny use by the enemy of sea and land bases in Alaska and the Aleutian Islands.
"To support the Navy."

6. To defend the Naval Base at Dutch Harbor will require air units in addition to the ground units now authorized and contemplated. Bombers will be required to attack enemy ships (including carriers, submarines, convoys and other shipping). Fighter aviation will be required to protect bombing operations and to furnish local air defense for the base itself.

7. To accomplish this, the following must be provided, (see Inclosure No. 1):

a. An air field in the vicinity of Dutch Harbor suitable

(ENCLOSURE A)

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for all types of military aircraft,

b. A chain of air fields, three in number, and not exceeding 300 miles apart due to the range of fighter aircraft, connecting Elmendorf Field, via Kodiak and Naknek, with the field in the vicinity of Dutch Harbor.

8. Research and reconnaissance indicate that suitable sites are available for the desired air field construction. Detailed reconnaissance of Umnak Island and Stepovak Bay have been directed by this headquarters. The Civil Aeronautics Authority has already completed a survey and estimate for Cold Bay (See Inclosure No. 3), and favor construction also at Port Heiden. Cost, construction and supply difficulties, if any, will not be any greater than other similar projects now under way in Alaska.

9. Garrisons over and above those now authorized will be required: The total should not exceed two reinforced Infantry Battalions; two 155-mm gun batteries and two batteries Coast Artillery (AA) Composite.

10. Unless adequate defensive installations are authorized, such facilities can and may be used directly to our disadvantage. Failure to protect them would be inexcusable.

11. To be specific: Aerial reconnaissance discloses that there exists a site on Umnak Island (see inclosure No. 2), which can be used now as an emergency landing field by an enemy. Hostile parachute troops and tools can be dropped from aircraft and used to prepare quickly these sites as advance bases. Unless a nearby area is occupied by adequate defense forces, the site mentioned above will be a definite threat against the Naval Base at Dutch Harbor. In other words, these areas will have to be garrisoned in order to deny them to an enemy whether or not we establish air fields on them. It is only necessary to point to the use now being made of parachute and air-borne troops in Europe to substantiate this. Occupation by us can only accrue to our advantage.

12. Failure to recognize these localities as potential enemy air bases can only have the effect of nullifying and jeopardizing the measures already taken and planned for the defense of Alaska. Without the occupation and preparation of sites on Umnak Island and Stepovak Bay as all-purpose fields, Dutch Harbor cannot be defended by other than carrier-based aircraft.

13. Other sites for landing fields in the vicinity of Dutch Harbor have been investigated (other than Umnak Island), and found to be not feasible and impracticable.

14. The creation of an adequate system of strategically located air fields with minimum ground defense at the more exposed fields will curb aggressive action in or near Alaska, permit the defense of those fields not garrisoned and thus permit the use of the Navy in other waters, if the situation so demands.

15. Until the reports of the reconnaissance mentioned in paragraph 8 above have been received, the system of air fields on the Aleutian Peninsula and on Umnak Island must be considered as tentative. Upon receipt of these reports, this headquarters will submit definite report recommending garrisons therefor.

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J.D. No. 312
(Serial 718)

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16. The Commanding General, Alaska Defense Command, is in agreement with these views.

J. L. DeWITT
Lieutenant General, U. S. Army
Commanding.

4 Incls:
1-Plan of Air Fields
2-Photos - Otter Point Area (Umnak Island)
3-Photos - Cold Bay Area.
4-cc Radio WD 4/26/41.

Copies furnished: Commandant, 13th Naval District, CG, Alaska Defense Command, on 6/5-41, Division Engineer, 6/12-41.

(ENCLOSURE A)

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J.B. No. 312
(Serial 718)

SECRET

HEADQUARTERS WESTERN DEFENSE COMMAND
Office of the Commanding General
Presidio of San Francisco

381/2-ADC WAR DEPARTMENT July 23, 1941.

SUBJECT: Air Defense of Naval Base at Dutch Harbor and of Alaska.

To : The Adjutant General, War Department, Washington, D. C.

1. Reference is made to:

a. Letter, Commanding General, Fourth Army, June 2, 1941, to the Chief of Staff, subject: "Air Defense of Naval Base at Dutch Harbor (Inclosure No. 1)".

b. Map - "Air field layout plan for Defense of Alaska (Inclosure No. 2)".

2. a. After exhaustive studies and reconnaissances by this headquarters, and by Headquarters Alaska Defense Command (as indicated in paragraph 8 of Inclosure No. 1), it has been determined that additional air fields must be provided at:

Otter Point (Umnak Island)
Cold Bay (Alaskan Peninsula)
Port Heiden (Alaskan Peninsula)

in order to provide an adequate defense of the Naval Base at Dutch Harbor and for Alaska. (See Inclosure No. 2).

(A recent survey of the practicability of air field construction at Stepovak Bay (as tentatively recommended in Inclosure No. 1) has determined that construction would be difficult and costs excessive. Therefore, that project must be disregarded.)

b. An all purpose field at Otter Point (Umnak Island) is necessary in order to base Pursuit aviation for the defense of the Naval Base at Dutch Harbor and from which bombing planes can operate for the defense of Alaska.

c. A field at Cold Bay is necessary as a staging field for all types of aircraft operating to the westward from Kodiak (and/or Naknek) and from which Pursuit aviation can be operated for the protection of bombers in transit from Kodiak (or Naknek) towards the Aleutians.

d. Due to the limited range of pursuit planes and to the generally adverse weather conditions existing in this area, an intermediate staging field must be provided between Kodiak and/or Naknek and Cold Bay. This field should be located at Port Heiden on the North side of the Alaskan Peninsula. Due to different weather conditions existing North and South of the Alaskan Peninsula, this field will insure continued operation of planes towards the Aleutians.

e. Unless these fields are provided:

(1) The Naval Base at Dutch Harbor cannot be properly defended.

(2) The entire structure of defensive facilities, as now provided will be weakened.

(3) Additional Naval Units (ships and planes) will have to be detached from the Fleet for use in this area.

f. When these fields are provided, the potential strength, made available thereby, will:

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(1) Constitute a positive threat against hostile action,

(2) Permit an active and strong defense by minimum local Army and Navy units (including aviation),

(3) Provide adequate facilities for the effective support of reinforcing aviation when situation demands.

3. In order to reduce construction, expense and delay, the following action is necessary:

a. Establish minimum garrisons at these stations.

b. Construct minimum dock facilities at each station, sufficient to accomodate, in normal weather, small transports and barges.

c. Construct essential local utilities at each station.

d. Construct storage for thirty (30) days at Otter Point (Umnak Island) and supply by boat from Dutch Harbor, where a ninety (90) day stockage will be maintained for both garrisons. Unless this system for the supply of Otter Point is used, extensive and expensive dock and harbor facilities will be required thereat.

e. Utilize CCC type buildings to the maximum extent possible at each station.

f. Utilize Engineer troops for construction. These troops can be used for defense during construction, and will reduce costs of construction and, eliminate labor difficulties.

4. Garrisons will be required as follows: (See Inclosure No. 3 for detailed breakdown).

a. OTTER POINT. (Umnak Island)
1 Infantry Battalion reinforced.
1 AA Battalion, consisting of Headquarters Battery, Two Gun Batteries, one Comp. Battery, one S.L. Battery.
1 155 mm Gun Battery with one Section S.L.
1 Squadron Pursuit Aviation.
Service Detachments.
TOTAL 122 (Officers) 2,455 (Enlisted Men)

b. COLD BAY. (Alaskan Peninsula)

1 Infantry Battalion reinforced, less two companies.
1 AA (G) Battery)
1 AA (Comp) Battery) with 1 Platoon S.L.
1 155mm Gun Battery with 1 Section S.L.
Service Detachments.
TOTAL 54 (Officers) 1,344 (Enlisted Men)

c. PORT HEIDEN. (Alaskan Peninsula)
1 Infantry Company (Rifle) less 1 Rifle Platoon with 1 Platoon Machine Gun (Caliber .30) attached.
Service Detachments.
TOTAL 10 (Officers) 258 (Enlisted Men)

5. Preliminary estimates of construction, subject to confirmation by detailed surveys, are as follows:

a. OTTER POINT. (Umnak Island)

Housing and related facilities	$2,524,900
Air Field Construction	
(1) Two concrete runways, or	2,532,700
(2) One concrete and One soil stabilized runway, or	2,155,600
(3) Two soil stabilized runways	1,681,600
Dock and related harbor facilities	1,000,000
TOTAL	(1) $6,057,600
	(2) 5,680,500
	(3) 5,206,500

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b. COLD BAY. (Alaskan Peninsula)

Housing and related facilities	$1,369,200
Air Field Construction	2,900,900
Dock	154,400
TOTAL	$4,424,500

c. PORT HEIDEN. (Alaskan Peninsula)

Housing and related facilities	$ 325,300
Air Field Construction	1,145,800
Dock	21,400
TOTAL	$1,492,500

6. The question of establishing these air fields has been the subject of correspondence for about one year. The trend of developments in the international situation, particularly as regards Japan and Russia with possibilities of Axis activities in the Pacific, towards Alaska, emphasizes the need for immediate action.

7. It is, therefore, urgently recommended that:

a. These projects be approved and funds for their construction be made available without delay.

b. Construction be made the responsibility of the Corps of Engineers and Engineer troops be used therefor.

8. a. The undersigned is convinced, as a result of his study and personal reconnaissance, the study and personal reconnaissance of the Commanding General, Alaska Defense Command, and the recent reconnaissance made by a board of Officers under direction of the Commanding General, Alaska Defense Command, that his conclusions as to the necessity for the establishment of additional air fields on the Alaskan Peninsula and in the Aleutians have been confirmed.

b. If the establishment of these three(3) additional air fields should not be favorably considered by higher authority, as a result of the presentation set forth in this communication and that of 6/2/41, (Inclosure No. 1), it is requested that before final decision to that effect is made, a physical survey of the localities recommended, be made by officers designated by the Secretary of War with a view to final determination of the military necessity therefor in the defense of this vital area.

c. If such a survey is determined upon, it should be initiated without delay. On the other hand, if these projects are approved, construction should be expedited by all possible means.

/s/ J.L. DeWitt

J. L. DeWITT
Lieutenant General, U. S. Army,
Commanding.

3 Incls.
1-Ltr CG, Fourth Army, to C/S dated 6/2/41. - Dup.
2-Air Field Layout plan for Defense of Alaska.
3-List of recommended personnel for additional Alaskan garrisons at Otter Point, Cold Bay, Port Heiden.

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Defense of Iceland /20/
and Greenland

FILE NO.
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Sept-Nov 1941
RETURNED TO THE ARCHIVES OF THE NAVY PICTORIAL OFFICER

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WAR DEPARTMENT
THE ADJUTANT GENERAL'S OFFICE
WASHINGTON

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IN REPLY
REFER TO AG 381
(9-30-41)MC-E

ACW/sm-1712 Auth: T. A. G.

November 5, 1941. Initials: DLC

Date, NOV - 5 1941

SUBJECT: J. B. No. 325 (Serial 731) - Joint Directive for the Defense of Iceland and Greenland.

TO: Chief of the Army Air Forces.

Inclosed for your information is copy of approved J. B. No. 325 (Serial 731), October 3, 1941, with copy of Inclosure (A) thereto, short title: NOAH, subject as above, which changes the missions and tasks as stated in J. B. No. 325 (Serial 697-1), Indigo-1, "Joint Army and Navy Directive for the Reinforcements of the Defenses of Iceland with a United States Army Pursuit Squadron (and Service Detachments)", and J.B. No.325 (Serial 697-3), Indigo-3, "Joint Army and Navy Directive for Augmenting the British Forces in Iceland with Troops of the United States Army and the United States Marine Corps", and also changes the tasks assigned in J. B. No. 325 (Serial 683).

By order of the Secretary of War:

D. L. Gerhardt
Adjutant General.

3 Incls:
#1-Cy J.B. No. 325 (Serial 731) 10-3-41, with inclosure thereto.
#2-Extract cy of notification of approval by the Secy. of the Navy.
#3-Cy of notification of approval by The President.

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THE JOINT BOARD
Joint Planning Committee
WASHINGTON

J.B. No. 325
(Serial 731)

September 30, 1941.

S E C R E T

From: The Joint Planning Committee.
To: The Joint Board.

Subject: Joint Directive for the Defense of Iceland and Greenland.

Enclosure: (A) Joint Army and Navy Basic Directive for the Defense of Iceland and Greenland (Short Title - NOAH).

1. In compliance with the wishes of the President, expressed in his memorandum to Admiral Stark, dated September 6, 1941, there is submitted herewith Enclosure (A), a Joint Army and Navy Basic Directive for the Defense of Iceland and Greenland, with the recommendation that it be approved by the Joint Board.

L. T. Gerow.
L. T. GEROW,
Brigadier General, U. S. Army.

R. K. Turner.
R. K. TURNER,
Real Admiral, U. S. Navy.

Approved by the President
Oct 30, 1941

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J.B. No. 325
(Serial 731)

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REGISTERED NO. 30

JOINT ARMY AND NAVY BASIC DIRECTIVE
FOR THE DEFENSE OF ICELAND AND GREENLAND

SHORT TITLE — NOAH

Prepared by:

The Joint Planning Committee

September, 1941.

Approved: _____
(Date) Secretary of War

Approved: _____
(Date) Secretary of the Navy.

Approved: _____
(Date)

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THE JOINT BOARD
JOINT PLANNING COMMITTEE
Washington

J.B. No. 325
(Serial 731)

September 30, 1941

S E C R E T

From: The Joint Planning Committee.
To: The Joint Board.

Subject: Joint Army and Navy Basic Directive for the Defense of Iceland and Greenland (Short Title, NOAH).

Reference: (a) J.B. No. 325 (Serial 697-1) Joint Army and Navy Directive for the Reinforcement of the Defenses of Iceland with a U.S. Army Pursuit Squadron (and Service Detachments), July 10, 1941, (Short Title, Indigo-1).

(b) J.B. No. 325 (Serial 697-3), Joint Army and Navy Directive for Augmenting the Existing British Defenses in Iceland with Troops of the U.S. Army and U.S. Marine Corps, August 15, 1941, (Short Title, Indigo-3).

(c) Basic Joint Army and Navy Plan for the Defense of Greenland, J.B. No. 325 (Serial 683), May 21, 1941.

(d) Change No. 4 to U.S. Navy Western Hemisphere Defense Plan No. 4, September 9, 1941, (Short Title, WPL-51).

1. a. The President in his memorandum to Admiral Stark dated September 6, 1941 stated:

"I hope you will check with the War Department and get a copy of their instructions to their air force in Greenland and Iceland; see whether these instructions conform to Navy instructions and arrange that they be identical."

b. Change No. 4 to the U.S. Navy Western Hemisphere Defense Plan No. 4 (Short Title WPL-51) was issued on September 9, 1941, by the Chief of Naval Operations under the direction of the President.

2. The Joint Planning Committee submits this Directive to bring the Greenland and Iceland plans into conformity with the President's desires.

3. a. The missions and tasks assigned in:

Indigo-1, Section IV, Paragraphs 8 and 9;
Indigo-3, Section IV, Paragraphs 10, 11 and 12, as changed by J.B. 325, Serial 697-3, September 2, 1941, are hereby cancelled and the following substituted therefor:

(1) JOINT TASKS IN CONNECTION WITH THE DEFENSE OF ICELAND.

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(a) IN COOPERATION WITH THE BRITISH AND THEIR ALLIED FORCES, DEFEND ICELAND AGAINST HOSTILE ATTACK.

(b) DESTROY GERMAN AND ITALIAN NAVAL, LAND, AND AIR FORCES ENCOUNTERED IN THE WESTERN ATLANTIC AREA.

NOTE No. 1. THE WESTERN ATLANTIC AREA lies west of a line running along the meridian of 10° West Longitude from the north as far south as Latitude 65° North. thence by ruhmb line to position 53° North Latitude, 26° West Longitude; thence south along the meridian of 26° West Longitude. The area extends as far West as the continental land masses but does not include the Naval Coastal Frontier and Naval District land and water areas, the Canadian Coastal Zones and the territorial waters of Latin American countries.

NOTE NO. 2. The presence of German or Italian naval, land or air forces in the WESTERN ATLANTIC AREA will be deemed conclusive evidence of hostile intent and will require attack on such forces unless an attack under the then existing circumstances would be tactically unsound.

(2) ARMY TASKS IN CONNECTION WITH THE DEFENSE OF ICELAND.

(a) IN COOPERATION WITH OTHER U. S. FORCES AND WITH THE BRITISH AND THEIR ALLIED FORCES, DEFEND ICELAND AGAINST HOSTILE ATTACK.

(b) DESTROY GERMAN AND ITALIAN NAVAL, AIR, AND LAND FORCES ENCOUNTERED IN THE WESTERN ATLANTIC AREA.

(c) WITHIN THE CAPABILITIES OF THE MEANS AVAILABLE, SUPPORT THE NAVY IN OPERATIONS IN THE WESTERN ATLANTIC AREA.

NOTE No. 1. The Navy General task is as follows:
The NAVAL ESTABLISHMENT will, within the assigned Operating Areas:

(a) Protect against hostile attack United States and foreign flag shipping, other than German and Italian shipping.

(b) Ensure the safety of sea communications with United States strategic outposts.

(c) Support the defense of United States territory and bases, Iceland, and Greenland.

NOTE No. 2. The U.S. Atlantic Fleet is assigned the following tasks in the WESTERN ATLANTIC AREA:

(a) Protect against hostile attack United States and foreign flag shipping other than German and Italian, by –

Escorting, covering, and patrolling, as circumstances may require, and by –

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Destroying German and Italian naval, land, and air forces encountered.

(b) Ensure the safety of sea communications with United States strategic outposts.

(c) Support the defense of United States territory and bases, Iceland, and Greenland.

(d) Trail merchant vessels suspected of supplying or otherwise assisting the operations of German and Italian naval vessels or aircraft. Report the movement of such vessels to the Chief of Naval Operations.

(3) NAVY TASKS IN CONNECTION WITH THE DEFENSE OF ICELAND.

(a) SUPPORT THE DEFENSE OF ICELAND AND ITS TERRITORIAL WATERS AGAINST ATTACK BY HOSTILE FORCES.

(b) PROVIDE PROTECTION AND SEA TRANSPORTATION FOR THE CONTINUED SUPPORT OF UNITED STATES FORCES IN ICELAND.

4. a. The tasks assigned in Basic Joint Army and Navy Plan for the Defense of Greenland (May 21, 1941), Section VII, Paragraphs 1, 2 and 3, are cancelled and the following substituted therefor:

Joint Tasks:

(1) JOINT TASKS IN CONNECTION WITH THE DEFENSE OF GREENLAND.

(a) DEFEND UNITED STATES INSTALLATIONS IN GREENLAND.

(b) PREVENT USE OF THE TERRITORY AND COASTAL WATERS OF GREENLAND BY THE NATIONALS OR AGENTS OF GERMANY AND ITALY, AND THEIR ACTIVE ALLIES.

(c) DESTROY GERMAN AND ITALIAN NAVAL LAND AND AIR FORCES ENCOUNTERED IN THE WESTERN ATLANTIC AREA.

NOTE No. 1. THE WESTERN ATLANTIC AREA lies west of a line running along the meridian of 10° West Longitude from the North as far South as Latitude 65° North, thence by rhumb line to position 53° North Latitude, 26° West Longitude, thence South along the meridian of 26° West Longitude. The area extends as far West as the continental land masses but does not include the Naval Coastal Frontier and Naval District land and water areas, the Canadian Coastal Zones and the territorial waters of Latin American countries.

NOTE No. 2. The presence of German or Italiam naval, land or air forces in the WESTERN ATLANTIC AREA will be deemed conclusive evidence of hostile intent and will require attack on such forces unless an attack

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under the then existing circumstances would be tactically unsound.

(2) ARMY TASKS IN CONNECTION WITH THE DEFENSE OF GREENLAND.

(a) DEFEND UNITED STATES MILITARY AND NAVAL INSTALLATIONS IN GREENLAND.

(b) DEFEND THE CRYOLITE MINE AT IVIGTUT.

(c) SUPPORTED BY THE NAVY, EXPEL FROM THE TERRITORY OF GREENLAND ANY HOSTILE ELEMENTS OR ANY NATIONALS OR AGENTS OF GERMANY AND ITALY, AND THEIR ACTIVE ALLIES.

(d) DESTROY GERMAN AND ITALIAN NAVAL, LAND AND AIR FORCES ENCOUNTERED IN THE WESTERN ATLANTIC AREA.

(e) WITHIN THE CAPABILITIES OF THE MEANS AVAILABLE, SUPPORT THE U. S. NAVY IN OPERATIONS IN THE WESTERN ATLANTIC AREA.

(3) NAVY TASKS IN CONNECTION WITH THE DEFENSE OF GREENLAND.

(a) DEFEND THE SEA COMMUNICATIONS BETWEEN GREENLAND AND NORTH AMERICA.

(b) SUPPORTED BY THE ARMY, PREVENT ACCESS TO THE TERRITORY AND TERRITORIAL WATERS OF GREENLAND BY ANY HOSTILE ELEMENTS OR ANY NATIONALS OR AGENTS OF GERMANY AND ITALY, AND THEIR ACTIVE ALLIES.

(c) SUPPORT THE ARMY IN THE DEFENSE OF GREENLAND.

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Auth: T.A.G.
Initials: DLV
Date: OCT 20 1941

AG 580 (9-22-41)MC-E LFL/ihw-1712

October 20, 1941

SUBJECT: J.B. No. 325 (Serial 683-1) - Defense Installations in Greenland.

TO: Chief of the Army Air Forces.

Inclosed for your information is copy of J.B. No. 325 (Serial 683-1), September 22, 1941, subject: Defense of Greenland, with inclosure (A) thereto. This report has been approved by the Secretary of War, the Secretary of the Navy, and the President.

By order of the Secretary of War:

D. R. VanDickler

Adjutant General.

1 Incl.
Cy J.B. No. 325
(Serial 683-1),
September 22, 1941,
w/incl. (A) thereto.

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THE JOINT BOARD
MUNITIONS BUILDING
WASHINGTON

J.B. No. 325
(Serial 683-1)

September 22, 1941.

S E C R E T

From: The Joint Board.

To: The Secretary of War.

Subject: Defense of Greenland.

Reference: (a) Joint Planning Committee report dated September 5, 1941.

Enclosure: (A) Reference (a).
(B) Joint letter addressed to The President.

The Joint Board has, on September 19, 1941, approved reference (a) and now transmits it to you recommending approval by the Secretaries of War and the Navy. It is further recommended that you sign the attached joint letter to The President recommending his approval of the report.

/s/ H. R. STARK,
Admiral, U.S. Navy,
Senior Member.

OCT 1 1941
APPROVED

/s/ Henry L. Stimson

Secretary of War.

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THE JOINT BOARD
Joint Planning Committee
Washington

J.B. No. 325
(Serial 683-1)

September 5, 1941.

SECRET

From: The Joint Planning Committee.

To: The Joint Board.

Subject: Defense Installations in Greenland.

References:
(a) Army - Navy Joint Basic Plan for the Defense of Greenland -- J.B. No. 325 (Serial 683).
(b) CNO Secret letter (SC)LF22-2, Ser. 069912 of 17 June 1941 with first end. J.B. No. 325 (Serial 683-1) of 18 June 1941.

Section I - The Directive.

1. Reference (b) requested definite recommendations as to the facilities and installations required in Greenland, and as to the service which should assume responsibility for each item, for the following purposes:

(a) To facilitate the defense of Greenland under the concept of reference (a).
(b) To support naval operations at sea in the vicinity of Greenland, including the increased sea patrol based in southern Greenland, of which study was directed by the President in his approval of reference (a).
(c) To facilitate ferrying aircraft overseas.

This report presents the recommendations requested in reference (b).

Section II. - Discussion.

2. The general concept of operations required for the defense of Greenland is quoted from reference (a) for ready reference:

"1. The terrain of Greenland is such that overland troop movements are not practicable except for short distances. Passage over the ice cap can be accomplished only by very small numbers of men after elaborate preparations. Accordingly, the establishment of garrisons of ground troops on shore is effective only for the local defense of particular points, and is ineffective as a means of denying to the enemy the use of other points. However, the availability in a central location of a garrison seasoned and trained in operating in the conditions existing, will be valuable as a force for minor landings elsewhere.

"2. The defense of Greenland is visualized, therefore, as consisting primarily of:

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a. Fleet operations to prevent access to the Greenland area by major enemy forces.

b. Local defense of vulnerable points.

c. Surface and air patrol of the remainder of the coast during seasons favorable to minor enemy operations.

d. Maintenance of civilian observers on shore in radio communications with our garrisons.

e. Maintenance of appropriate forces in readiness to repel minor attack and to dislodge enemy units landed or operating in the waters of Greenland.

"3. The vulnerable objectives requiring local defenses are:

a. Any airdrome established in Greenland.

b. Other United States installations in Greenland.

c. The Cryolite mine at Ivigtut.

d. Sea communications and shipping.

"4. Other than airdromes, the United States installations requiring defense will probably be limited to radio and weather stations and to depots containing fuel and other supplies. In order to facilitate defense these installations will be made, so far as practicable, at sites requiring defense for other purposes. The scale of attack to be expected against such installations is small. A landing party from a raider is the probable maximum.

"5. The essential corollary to restriction of the defensive forces in Greenland to a few important places is maintenance of other forces in readiness to reinforce local defenses or to attack enemy units landed or operating in the waters of Greenland. Such forces may consist of:

a. Small detachments of troops serving ordinarily with the principal garrisons but equipped and trained for arctic service and in readiness for transportation in naval vessels to points where movements overland may be initiated.

b. Air units of minor strength in the Newfoundland area available for movements by air to Greenland. Effective use of such units will be dependent on adequate stocks of fuel, ammunition, and other supplies at airdromes in Greenland, or in the case of seaplanes, upon adequate tenders."

3. The logistic difficulties of constructing and maintaining defense installations in Greenland are increased by the distances from sources of supply, by the lack of local labor, and by the difficulty of access to the points concerned because of ice conditions. Supplies of all sorts for defense garrisons, as well as aviation fuel, lubricants, and spares for the use of aircraft must be sent in during the open season in quantities sufficient to last through the closed season at each defense site.

4. The transportation of supplies to Greenland must in any case be accomplished by sea or by air. In many

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cases it must be accomplished by ships suitable for work in the ice. The number of such ships available is limited.

5. The army has the task of facilitating the ferrying of aircraft overseas via Canada or Newfoundland, Greenland and Iceland. One main airdrome site has been selected at Narsarssuak (Tunugdliarfik Fjord) and an emergency landing field site has been selected at Kipisako. Engineer troops and material have been sent to Greenland to start work on these fields. When completed the fields will serve also as airdromes for the use of aircraft assigned to defend Greenland or to control its coast and coastal waters.

6. The prevalent adverse weather and the expected heavy overseas air traffic combine to create the need for a complete airway weather service and for radio aids to air navigation. In addition, radio facilities for administrative and command purposes will be required by the Army garrisons.

7. The position of Greenland with respect to the existing naval strategic direction finder stations and to the North Atlantic shipping units is such as to make it a desirable location for a radio direction finding and intercept station for naval strategic purposes. Such a station must of necessity be located in an outlying position with minimum of interference from mountains.

8. The operation of naval seaplanes in Greenland must always be intermittent and limited because of ice conditions. It is true that tender based operations are practicable during the summer and fall, but only if facilities are available for hauling out seaplanes to secure them during heavy winds. Accordingly, it is advisable to have ramps constructed wherever seaplanes are to operate, and at all airdromes if possible. On the other hand, it will be practicable to operate amphibian airplanes from air fields. The needs for seaplane facilities will be intermittent. In the interests of economy and simplicity of administration, seaplane and amphibian facilities should be constructed and maintained by the agency which provides the landplane facilities.

9. The naval surface units at present most suitable for operations in Greenland are the NORTHLAND, the Coast Guard cutters of the COMANCHE class, the NORTH STAR and the BEAR. Three 5000 ton ice breaker type cutters of an improved type are under construction for the Coast Guard. All of these ships are diesel-engined. There exists a need for a storage in Greenland for diesel oil and lubricants for these ships, with which there can be advantageously combined a small storage for fuel oil for naval and commercial vessels, aviation fuel and lubricants, and miscellaneous supplies. In addition, seaplane moorings and material for constructing ramps will be required.

10. Consideration of strategic matters and a study of the various Army and Navy survey parties and other units sent to Greenland lead to the conclusion that the installations immediately required are:

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(a) At Narsarssuak:

(1) An airdrome having facilities required by aircraft operating for the defense of Greenland, in support of naval operations, or en route overseas.

(2) Installations necessary for a defense garrison, including one bombardment squadron, one pursuit squadron and a total of approximately 2050 officers and men.

(3) Facilities to accommodate the personnel of transient aircraft, including those of the United States Navy.

(4) Aviation fuel storage sufficient for six months' operations, estimated as approximately 2,000,000 gallons of aviation gasoline and 30,500 gallons of lubricating oil.

(5) Ramps and parking area to permit hauling out naval seaplanes.

(b) In the vicinity of Ivigtut:

(1) An emergency landing field at Kipisako, with necessary facilities for use as an auxiliary to the field at Narsarssuak.

(2) Installations for a garrison of approximately 550 officers and men.

(3) Fuel storage for 10,000 barrels of fuel oil, 40,000 barrels of diesel oil, 50,000 gallons of aviation gasoline, miscellaneous supplies for the ships and aircraft operating in South Greenland waters. Housing for a caretaking detachment of approximately ten men should be provided.

(c) At Siniutak Island:

Facilities for obtaining radio bearings and intercepts for Naval strategic purposes; radio aids to air navigation; facilities for communication with aircraft in flight; and facilities for communication with Army and Navy units in Greenland, Newfoundland and the United States.

(d) At Narsarssuak, Kipisako, and outlying points:

a meteorological and radio communication service covering both Greenland coasts.

11. If an airdrome is established by the Government of Canada at Northwest River, Labrador, as has recently been proposed, an airdrome in the Sondrestromfjord will also be desirable, for the purpose of providing an emergency landing place for aircraft flying from Northwest River via the northward route.

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J.B. No. 325
(Serial 683-1)

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Section III. - Summary of Personnel Requirements.

12. The personnel requirements are estimated to be as follows:

	Officers	Men	Nurses
Army			
Narsarssuak	180	1850	20
Ivigtut	21	460	2
* Kipisako	1	20	-
Simiutak Island	(Included in Narsarssuak)		
Sondrestrom Fjord (if established)	25	530	2
** Outlying meteorological Stations	--	72	-
Total	227	2932	24
Navy			
Ivigtut	1	9	-
Simiutak Island	1	15	-
Total	2	24	-
GRAND TOTAL	229	2956	24

* To be defended by Ivigtut Garrison.
** Native operators will be employed when and if practicable.

Section IV. - Recommendations.

13. It is recommended that the Army provide:

(a) The Narsarssuak airdrome, and the emergency field at Kipisako, complete with facilities required for the operation of a bombardment and a pursuit squadron and transient aircraft, and including at Narsarssuak a ramp and parking area for seaplanes.

(b) The installations necessary for Army garrisons at Narsarssuak, Ivigtut and such other places as may be occupied, totalling approximately 3183 officers, men and nurses.

(c) All shore meteorological facilities in Greenland, including a central weather station at Narsarssuak and such outlying weather reporting stations as may be required.

(d) Such additional airdromes as may be required for ferrying aircraft overseas, including, at each airdrome where practicable, a ramp to permit occasional visits by Naval seaplanes.

14. It is recommended that the Navy provide a Naval Fuel Depot at Ivigtut with storage for fuel and miscellaneous supplies for the ships and aircraft operating in South Greenland waters, and with housing for a caretaking detachment of 1 officer

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and 9 men. It is to be understood that the Navy will provide, from the Ivigtut Naval Fuel Depot or by fuel ships, fuel oil, diesel oil, gasoline, and lubricating oil, for the operation of Army and Navy vessels, airplanes, and shore installations in Greenland.

15. It is recommended that Greenland shore radio facilities be provided by the Army, except that the Navy shall provide, in conjunction with the Army radio station at Siniutak, facilities for obtaining radio bearings and intercepts for naval strategic purposes, for communication with naval units in the Greenland area, and for communication with naval radio stations in Newfoundland and the United States.

(Signed)L. T. Gerow

L. T. GEROW,
Brigadier General, U.S. Army.

(Signed) R. K. Turner

R. K. TURNER,
Rear Admiral, U.S. Navy.

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THE JOINT BOARD
Munitions Building
Washington

October 3, 1941.

J.B. No. 325
(Serial 731)

S E C R E T

From: The Joint Board.

To: The Secretary of War.

Subject: Joint Directive for the Defense of Iceland and Greenland (Short Title - NOAH).

Reference: (a) Joint Planning Committee report of September 30, 1941, with Subject Directive.

Enclosures: (A) Reference (a).
(B) Joint letter to The President.

The Joint Board, on October 1, 1941, approved the subject directive, and now transmits it to the Secretaries of War and the Navy recommending their approval. It is further recommended that it be transmitted to The President by the attached joint letter recommending his approval.

(Sgd) H. R. Stark

H. R. Stark,
Admiral, U.S. Navy,
Senior Member.

APPROVED: OCT. 16, 1941

(Sgd) Henry L. Stimson

Secretary of War.

Incl. #1 to letter, AGO,
11-5-41, AG 381 (9-30-41)MC-E

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THE JOINT BOARD
Munitions Building
Washington

October 31, 1941.

MEMORANDUM FOR THE CHIEF OF STAFF:

Subject: Joint Army and Navy Basic Directive for the Defense of Iceland and Greenland. Short Title - Neal. J.B. No. 325 (Serial 731)

You are advised that the subject Joint Board serial was approved by The President on October 30, 1941.

(Sgd) W. P. Scobey

W. P. SCOBEY,
Colonel, G. S. C.,
Secretary.

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Incl. # / to letter, AGO,
11-5-41, AG 381 (9-30-41)MC-E

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THE JOINT BOARD
Munitions Building
Washington

October 11, 1941.

MEMORANDUM FOR THE CHIEF OF STAFF:

Subject: Approval of Joint Board Serials by the Secretary of the Navy.

You are advised that the Secretary of the Navy approved the following Joint Board serials on October 9, 1941:

* * * * *

J.B. No. 325 (Serial 731) -- Joint Directive for the Defense of Iceland and Greenland (Short Title: Noah).

(Sgd) W. P. Scobey

W. P. SCOBEY,
Lieut. Colonel, G. S. C.,
Secretary.

Incl. #1 to letter, AGO,
11-5-41, AG 381 (9-30-41)MC-E

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THE JOINT BOARD
Joint Planning Committee
Washington

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J.B. No. 325
(Serial 683)

May 21, 1941.

From: The Joint Planning Committee.

To: The Joint Board.

Subject: Joint Plan for the Defense of Greenland.

Reference : (a) Letter to The Joint Board from the Acting Chief of Staff (OCS 21068-21) dated April 12, 1941, referred to the Joint Planning Committee by 1st Indorsement, April 12, 1941.

Enclosure : (A) Basic Joint Army and Navy Plan for the Defense of Greenland.

In compliance with the directive contained in Reference (a), there is submitted herewith Enclosure (A) a Basic Joint Army and Navy Plan for the Defense of Greenland, with the recommendation that it be approved by The Joint Board.

L. T. GEROW,
Brigadier General, U.S. Army.

R. K. TURNER,
Rear Admiral, U.S. Navy.

APPROVED:

June 2, 1941 — Henry L. Stimson
Secretary of War.

APPROVED:

May 29, 1941 — Frank Knox
Secretary of the Navy.

June 7, 1941
APPROVED: Subject to further study of
(a) increasing the sea patrol based on Southern Greenland.
(b) study of use of ice-cap West of Scoresby Sound by patrol planes.

Franklin D. Roosevelt

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J.B. No. 325
(Serial 683)

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BASIC JOINT ARMY AND NAVY PLAN FOR THE DEFENSE OF GREENLAND

Section I. DIRECTIVE.

On April 12, 1941, the Joint Planning Committee received a directive from The Joint Board as follows:

"On April 9, 1941, The President announced that the United States had signed an agreement with the Danish Minister in Washington, who acted on behalf of the King of Denmark, including Greenland in the United States system of cooperative hemispheric defense.

"In view of this announcement, it is recommended that The Joint Board develop without delay a basic joint plan for the defense of Greenland, which will be in harmony with the terms of the agreement concluded between the United States and Denmark and, also, will give due consideration to War Department plans already in process of development."

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J.B. No. 325 (Serial 683) SECTION II SECRET

AGREEMENT RELATING TO THE DEFENSE OF GREENLAND

WHEREAS:

ONE. After the invasion and occupation of Denmark on April 9, 1940 by foreign military forces, the United Greenland Councils at their meeting at Godhavn on May 3, 1940 adopted in the name of the people of Greenland a resolution reiterating their oath of allegiance to King Christian X of Denmark and expressing the hope that, for as long as Greenland remains cut off from the mother country, the Government of the United States of America will continue to hold in mind the exposed position of the Danish flag in Greenland, of the native Greenland and Danish population, and of established public order; and

TWO. The Governments of all of the American Republics have agreed that the status of regions in the Western Hemisphere belonging to European powers is a subject of deep concern to the American Nations, and that the course of military events in Europe and the changes resulting from them may create the grave danger that European territorial possessions in America may be converted into strategic centers of aggression against nations of the American Continent; and

THREE. Defense of Greenland against attack by a non-American power is essential to the preservation of the peace and security of the American Continent and is a subject of vital concern to the United States of America and also to the Kingdom of Denmark; and

FOUR. Although the sovereignty of Denmark over Greenland is fully recognized, the present circumstances for the time being prevent the Government in Denmark from exercising its powers in respect of Greenland.

THEREFORE,

The undersigned, to wit: CORDELL HULL, Secretary of State of the United States of America, acting on behalf of the Government of the United States of America, and HENRIK DE KAUFFMANN, Envoy Extraordinary and Minister Plenipotentiary of His Majesty the King of Denmark at Washington, acting on behalf of His Majesty the King of Denmark in His capacity as sovereign of Greenland, whose authorities in Greenland have concurred herein, have agreed as follows:

ARTICLE I

The Government of the United States of America reiterates its recognition of and respect for the sovereignty of the Kingdom of Denmark over Greenland. Recognizing that as a result of the present European war there is danger that Greenland may be converted into a point of aggression against nations of the American Continent, the Government of the United States of America, having in mind its obligations under the Act of Habana signed on July 30, 1940, accepts the responsibility of assisting Greenland in the maintenance of its present status.

ARTICLE II

It is agreed that the Government of the United States of America shall have the right to construct, maintain and

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operate such landing fields, seaplane facilities and radio and meteorological installations as may be necessary for the accomplishment of the purposes set forth in Article I.

ARTICLE III

The grants of the rights specified in Article II shall also include the right to improve and deepen harbors and anchorages and the approaches thereto, to install aids to navigation by air and by water, and to construct roads, communication services, fortifications, repair and storage facilities, and housing for personnel, and generally, the right to do any and all things necessary to insure the efficient operation, maintenance and protection of such defense facilities as may be established.

ARTICLE IV

The landing fields, seaplane, harbor and other defense facilities that may be constructed and operated by the Government of the United States of America under Articles II and III will be made available to the airplanes and vessels of all the American Nations for purposes connected with the common defense of the Western Hemisphere.

ARTICLE V

It is agreed that the Government of the United States of America shall have the right to lease for such period of time as this Agreement may be in force such areas of land and water as may be necessary for the construction, operation and protection of the defense facilities specified in Articles II and III. In locating the aforesaid defense areas, the fullest consideration consistent with military necessity shall be given to the welfare, health and economic needs of the native population of Greenland. It is agreed, however, that since the paramount objective sought is the early attainment of an adequate defense establishment in Greenland, the utilization of any area deemed by the Government of the United States of America to be needed for this purpose shall not be delayed pending the reaching of an agreement upon the precise terms of a formal lease. A description of such areas, by metes and bounds, and a statement of the purpose for which they are needed shall in each case be communicated to the Danish authorities in Greenland as soon as practicable, and the negotiation of a formal lease shall be undertaken within a reasonable period of time thereafter.

ARTICLE VI

The Kingdom of Denmark retains sovereignty over the defense areas mentioned in the preceding articles. So long as this Agreement shall remain in force, the Government of the United States of America shall have exclusive jurisdiction over any such defense area in Greenland and over military and civilian personnel of the United States, and their families, as well as over all other persons within such areas except Danish citizens and native Greenlanders, it being understood, however, that the Government of the United States may turn over to the Danish authorities in Greenland for trial and punishment any person committing an offense within a defense area, if the Government of the United States shall decide not to exercise jurisdiction in such case. The Danish authorities in Greenland will take

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adequate measures to insure the prosecution and punishment in case of conviction of all Danish citizens, native Greenlanders, and other persons who may be turned over to them by the authorities of the United States, for offenses committed within the said defense areas.

ARTICLE VII

It is agreed that the Government of the United States of America shall have the right to establish and maintain postal facilities and commissary stores to be used solely by military and civilian personnel of the United States, and their families, maintained in Greenland in connection with the Greenland defense establishment. If requested by the Danish authorities in Greenland, arrangements will be made to enable persons other than those mentioned to purchase necessary supplies at such commissary stores as may be established.

ARTICLE VIII

All materials, supplies and equipment for the construction, use and operation of the defense establishment and for the personal needs of military and civilian personnel of the United States, and their families, shall be permitted entry into Greenland free of customs duties, excise taxes, or other charges, and the said personnel, and their families, shall also be exempt from all forms of taxation, assessments or other levies by the Danish authorities in Greenland.

ARTICLE IX

The Government of the United States of America will respect all legitimate interests in Greenland as well as all laws, regulations and customs pertaining to the native population and the internal administration of Greenland. In exercising the rights derived from this Agreement the Government of the United States will give sympathetic consideration to all representations made by the Danish authorities in Greenland with respect to the welfare of the inhabitants of Greenland.

ARTICLE X

This Agreement shall remain in force until it is agreed that the present dangers to the peace and security of the American Continent have passed. At that time the modification or termination of the Agreement will be the subject of consultation between the Government of the United States of America and the Government of Denmark. After due consultation has taken place, each party shall have the right to give the other party notice of its intention to terminate the Agreement, and it is hereby agreed that at the expiration of twelve months after such notice shall have been received by either party from the other this Agreement shall cease to be in force.

Signed at Washington in duplicate, in the English and Danish languages, both texts having equal force, this 9th day of April, nineteen hundred and forty-one.

SEAL

CORDELL HULL
Secretary of State of the
United States of America.

SEAL

HENRIK KAUFFMANN
Envoy Extraordinary and Minister
Plenipotentiary of His Majesty
the King of Denmark at Washington

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J. D. No. 325
(Serial 603)

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Section III - THE SITUATION.

1. To avoid ambiguity in this plan and supporting measures, the following terms will be used with respect to various parts of Greenland:

(a) Northeast Greenland - From Cape Brewster to Cape Morris Jessup.
(b) Southeast Greenland - From Cape Farewell to Cape Brewster.
(c) Southwest Greenland - From Cape Farewell to Upernivik.
(d) Northwest Greenland - From Upernivik to Cape Morris Jessup.

2. Meteorological information from stations in Greenland is important to Germany. During the summer of 1940 Germany made several attempts to establish weather stations in Northeast Greenland, sending small Norwegian vessels under German control to the region between Cape Brewster and Mackenzie Bay. Great Britain sent an ex-Norwegian gunboat to the region in order to eliminate the German-controlled stations. German aircraft have since been sighted, once in King Oscar Fjord and twice in Scoresby Sound, and it is suspected that a German controlled weather station may be in operation.

3. It can be expected that Germany will continue her efforts to establish weather stations in Northeast Greenland. Owing to ice conditions, the only German activity believed to be feasible during the period from September to July is the maintenance or establishment of such stations by air. During July and August ships especially constructed for work in ice might be used by Germany to establish new or additional weather stations or to send supplies to stations already established. Attempts may be made to use submarines or airplanes, or both, to send personnel and material into the area. An attempt might also be made to establish aviation facilities, but it seems probable that such facilities would be limited to those needed for aircraft cooperating with weather stations.

4. If the Germans should succeed in establishing and maintaining a base for long-range aircraft in Northeast Greenland, such aircraft could operate against any part of Greenland. The logistic problem for aircraft in this region would be difficult.

5. There is a remote possibility of German raids during the open season by surface or submarine craft against other parts of Greenland. Such raids probably would be directed against the Cryolite mine at Ivigtut or against United States military or naval installations in Greenland, both during and after their establishment. Difficulties of navigation and maneuver in the narrow fjords which ships would have to traverse in order to attack any of these points, would constitute important factors favoring the defense.

6. As long as the British Fleet remains in the Eastern Atlantic it is believed that German activities in Greenland will be limited in general to those outlined above. If Germany should gain control of the Eastern Atlantic and

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occupy Iceland, her aircraft based in Iceland could at times operate against practically any part of Greenland and could control Northeast Greenland. Should control of the Eastern Atlantic pass to Germany, raids against Southwest Greenland would become somewhat more probable, and it is possible that Germany might then attempt to establish an advanced air base, or a base for light naval forces, in Southwest Greenland.

7. From a base in Southwest Greenland German long-range aircraft could operate against Newfoundland and Eastern Canada. However, owing to the distances involved, to difficulties of supply and to adverse weather conditions, such operations would be sporadic in nature and small in scale.

8. The Greenland Government has requested that no United States forces be established at Godthaab, the capital of South Greenland; that Ivigtut be furnished with the maximum possible military protection; and that the United States leave the existing radio network under the control of the Greenland authorities and set up its own communication system.

9. Godthaab, although the seat of the local Government, has no other military significance. Julianehaab is the largest settlement in Greenland. Ivigtut has the greatest commercial importance. There is no compelling reason for establishing military forces at Godthaab.

10. The importance of Cryolite to the aluminum industry in the United States, the United Kingdom and Canada, together with the vulnerability of the mine at Ivigtut makes the latter an attractive and perhaps a profitable object of attack. The mine is subject to flooding in the event of a rupture of the protective sea wall through sabotage or hostile action. The present defenses of Ivigtut are inadequate against hostile raids, though adequate against sabotage. For the protection of the mine, the Greenland authorities now employ a detachment of former United States Coast Guardsmen, armed with a 3-inch gun, machine guns, rifles and pistols purchased from the United States. The Greenland authorities propose to supplement these measures by stationing an inspection boat at the entrance to the fjord on which the mine is located, with communications to the gun site. The Greenland Government has proposed that the United States repurchase the foregoing armament when it establishes its own defense forces. The tentative selection of Kungnat Bay as the best site in Southwest Greenland for operating patrol planes from a tender, and the value of the commercial port facilities at Ivigtut add to the importance of adequate defense of that port.

11. The United States Government plans to establish one or more landing fields in Greenland for the purpose of staging aircraft to England by air. As the result of surveys already completed, a site for a landing field has been tentatively selected at the head of the Tunugdliarfik Fjord near Julianehaab. Preparations are being made to begin construction of the field. Further surveys are planned for the purpose of locating a landing field in the Angmagssalik area on the east coast and one on the west coast, probably in the vicinity of the Sondrestromfjord. Any naval facilities established in Greenland should, if practicable, be located in the vicinity either of airdromes being established by the Army or of points such as Ivigtut which require defense for other reasons.

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12. Defensive garrisons must be provided for the defense of each airdrome. The location of airdrome sites near the heads of fjords, fifty to one hundred miles from the open sea, facilitates their defense against attack by ships or by troops landed from ships. Airdromes on the west coast will not be exposed to heavy air attack until such time as hostile aircraft may be based in Iceland or in East Greenland. The prevalence of bad weather decreases the probability of attack by strong enemy air forces. It also makes short range antiaircraft weapons more important than those of longer range. The probability that enemy action may consist primarily of observation and sporadic raids by a very few long range aircraft makes it probable that a relatively small number of pursuit aircraft will contribute greatly to the defense.

13. Southeast Greenland can be patrolled intermittently by aircraft. During the summer months patrol planes based either in Southwest Greenland or on Iceland may be used. Landplanes or amphibian patrol planes operating from the Julianehaab area can perform this patrol throughout the year whenever weather permits.

14. Southwest Greenland can be patrolled by suitable ships, and by aircraft operating from the Julianehaab area or even from Newfoundland.

15. The difficulties of travel in Greenland make it necessary to rely on a local radio net for intercommunication between the various settlements. This net can also be used for the transmission of military information. With some expansion it might be made to serve as a means whereby the commanders of military and naval defensive forces may be apprised of enemy activities wherever occurring. While the sparsely settled condition of the country makes it easy to avoid the settlements it also makes entry into them or any activity outside them immediately noticeable. Accordingly an intelligence system which uses the natives as observers and the existing radio system for communications should be quite effective.

Section IV - PURPOSE OF THIS PLAN.

1. The purpose of this plan is to provide for the joint measures required for the defense of United States installations in Greenland and for the defense of Greenland against aggression on the part of a European Power or Powers.

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Section V - ASSUMPTIONS.

1. That the establishment of strong non-American military forces in Northeast Greenland would not be practicable or useful strategically.

2. That Greenland is unsuitable as an advanced base for the assembly of European forces for a major military expedition against North America.

3. That United States naval forces can prevent the establishment in South Greenland, by non-American Powers, of strong military forces which must be transported and maintained by sea transportation.

4. That the difficulties connected with the establishment and maintenance by air of non-American military forces in South Greenland are so great as to render it improbable that effective military forces will be so established.

Section VI - GENERAL CONCEPT OF OPERATIONS REQUIRED.

1. The terrain of Greenland is such that overland troop movements are not practicable except for short distances. Passage over the ice cap can be accomplished only by very small numbers of men after elaborate preparations. Accordingly, the establishment of garrisons of ground troops on shore is effective only for the local defense of particular points, and is ineffective as a means of denying to the enemy the use of other points. However, the availability in a central location of a garrison seasoned and trained in operating in the conditions existing, will be valuable as a force for minor landings elsewhere.

2. The defense of Greenland is visualized, therefore, as consisting primarily of:

a. Fleet operations to prevent access to the Greenland area by major enemy forces.
b. Local defense of vulnerable points.
c. Surface and air patrol of the remainder of the coast during seasons favorable to minor enemy operations.
d. Maintenance of civilian observers on shore in radio communication with our garrisons.
e. Maintenance of appropriate forces in readiness to repel minor attack and to dislodge enemy units landed or operating in the waters of Greenland.

3. The vulnerable objectives requiring local defenses are:

a. Any airdrome established in Greenland.
b. Other United States installations in Greenland.

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c. The Cryolite mine at Ivigtut.
d. Sea communications and shipping.

4. Other than airdromes, the United States installations requiring defense will probably be limited to radio and weather stations and to depots containing fuel and other supplies. In order to facilitate defense these installations will be made, so far as practicable, at sites requiring defense for other purposes. The scale of attack to be expected against such installations is small. A landing party from a raider is the probable maximum.

5. The essential corollary to restriction of the defensive forces in Greenland to a few important places is maintenance of other forces in readiness to reinforce local defenses or to attack enemy units landed or operating in the waters of Greenland. Such forces may consist of:

a. Small detachments of troops serving ordinarily with the principal garrisons but equipped and trained for arctic service and in readiness for transportation in naval vessels to points where movements overland may be initiated.
b. Air units of minor strength based in Greenland.
c. Air units of moderate strength in the Newfoundland area available for movement by air to Greenland. Effective use of such units will be dependent on adequate stocks of fuel, ammunition, and other supplies at airdromes in Greenland, or in the case of seaplanes, upon adequate tenders.

6. The most effective means available for preventing enemy activity in Northeast Greenland are:
a. To send into the area, each year as early as ice conditions permit, armed ships suitable for arctic work, equipped with aircraft for observation purposes, and prepared to land armed detachments to seize the personnel and material of any enemy activity located. These ships should remain in the area as late as practicable.
b. To supplement the activities of these ships and to give them effective support by patrol planes based in Iceland. If Iceland should fall into non-British hands and control of the adjacent sea areas should be in dispute, it would probably become impracticable to deny enemy activities in Northeast Greenland.

Section VII - TASKS.

1. Joint General Tasks.
a. Defend United States installations in Greenland.
b. Defend Greenland and its sea communications to North America against attack by non-American Powers.
c. Prevent use of the territory and coastal waters of Greenland by the nationals or agents of non-American belligerent nations.

2. Army General Tasks.
a. Defend United States military and naval installations in Greenland.
b. Defend the Cryolite mine at Ivigtut.

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c. Supported by the Navy, expel from the territory of Greenland any hostile elements or any nationals or agents of non-American belligerent nations which may be established there.

d. Support the Navy.

3. Navy General Tasks.

a. Defend the sea communications between Greenland and North America.

b. Defend shipping in the coastal waters of Greenland.

c. Supported by the Army, prevent access to the territory and territorial waters of Greenland by any hostile elements or the nationals or agents of belligerent non-American nations.

d. Support the Army.

Section VIII - FORCES.

A. Army.

1. Since the location of all the proposed airdromes will not be definitely determined until the surveys now in progress have been completed, and the defense requirements must be determined by further reconnaissance, only a very general estimate can now be given of the Army forces required at each site.

2. With full use of personnel for multiple tasks and the manning of alternative weapons, it is estimated that a composite garrison of about 500 officers and men with one flight of pursuit airplanes should suffice for each airdrome. These garrisons should be so organized and equipped that they can provide small detachments for minor landings elsewhere if required. They should be armed with 37 mm AA guns, cal. .50 machine guns (AA), cal. .30 machine guns, rifles, searchlights and, if necessary, two 155 mm guns. During 1941 the only airdrome garrison required will be one for the airdrome at Tunugdliarfik Fjord.

3. It is estimated that a composite garrison of about 100 officers and men will be required at Ivigtut. This garrison should be armed with rifles, machine guns, 37 mm AA guns, and two 155 mm guns.

B. Navy.

1. The forces available at this time for the patrol of Northeast Greenland consist of the NORTHLAND, BEAR and NORTH STAR. These ships are to be armed and equipped for service in Northeast Greenland in the summer of 1941. Each will carry an amphibian plane equipped to carry 100-lb. bombs and machine guns. Each ship will have its crew augmented to provide landing parties if required.

2. The patrol plane squadrons available to support these three small ships are those of the Atlantic Fleet. Their numbers will vary in accordance with requirements outside the scope of this plan.

3. The naval forces immediately available for Southwest and Scutheast Greenland are the Coast Guard Cutters assigned by the Navy Department to operate in those waters from tine to time. In June 1941 they will include the MODOC, one 165' cutter strengthened for ice breaking, and one 110' ice breaking tug.

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An additional 165' cutter is available if required.

4. Ships and aircraft of the Atlantic Fleet are available to operate in Greenland as directed by the Chief of Naval Operations.

5. For planning purposes, the naval forces normally available for Greenland in 1941 should be assumed to be:

Northeast Greenland Patrol, operating under the Commander-in-Chief, U. S. Atlantic Fleet.

1 AG (NORTHLAND), with 1 VJ.
2 XAG (BEAR and NORTH STAR), each with 1 VJ.
Patrol planes and tender from the Atlantic Fleet as required.

South Greenland Patrol, operating directly under the Chief of Naval Operations.

3 XPC (MODOC, ALGONQUIN, COMANCHE)
1 XAT (RARITAN)
1 AG (BOWDOIN)
3 VP and 1 AVP (from the Atlantic Fleet or from the North Atlantic Naval Coastal Frontier Force)

6. Units from the Northeast Greenland Patrol may be assigned to augment or replace units of the South Greenland Patrol when ice conditions prevent operations on the Northeast coast.

Section IX - EXECUTION OF THE PLAN.

1. Immediately upon the approval of this plan by the President, it will be placed in effect by normal administrative means.

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Joint A-B Planning
Sub-Committee
Data
A-WPD Division
Strategical Planning and
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Lt. Col. K. N. Walker
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J.C.S. Memo
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STRATEGICAL MOVEMENTS + PROJECTS

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D R A F T - 1/8/42

JOINT PLANNING COMMITTEE

DRAFT REPORT FOR THE CHIEFS OF STAFF COMMITTEE.

Subject: Defense of Island Bases between Hawaii and Australia.

1. There is under development and approaching completion an air route suitable for the use of both long and medium range aircraft and extending from Hawaii to Australia. Airdromes are located at Palmyra, Christmas, Canton, American Samoa, Fiji and New Caledonia. In addition to their use as staging points along the air route, all of these islands are valuable components of the defenses of the Hawaiian Islands or of New Zealand and Australia. They will serve also as operating bases for naval and air forces.

2. In addition to its military importance, New Caledonia is an important Japanese objective since it is the principal readily accessible source of supply for nickel of which the Japanese have at present only a limited supply. At present the total output of nickel is shipped to the United States. In emergency this source of supply could be denied to the Japanese for some time by the destruction of the blast furnaces, power supply and limited loading facilities.

3. It is planned also to establish at Bora Bora, in the Society Islands, a base for refuelling naval vessels and other shipping en route to and from the South West Pacific.

4. The defense of all the island positions along the route depends ultimately upon their support by naval and air forces. The strength of their garrisons should be made adequate to hold them for the length of time which may elapse

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before naval and air support can be made effective. In the present situation, the Japanese appear to be able to attack New Caledonia or Fiji at an early date with a force of at least one infantry division supported by strong naval and air forces.

5. The present garrisons of the island bases are inadequate to hold out unsupported against the attacks of which the Japanese are capable. The degree of resistance to the Japanese of the French and native troops in New Caledonia is unknown.

6. The United States is able to provide sufficient forces for the defense of Palmyra, Christmas, Canton, American Samoa and Bora Bora. The attached table shows forces present in the islands, en route and planned to be sent in the future as shipping and naval escorts become available. The table also shows further measures to meet ultimate requirements.

7. New Zealand is sending most of the personnel needed for the defense of Viti Levu. The United States is providing one pursuit squadron and very considerable quantities of the equipment required for the Fijis. The remainder is being supplied from British sources. Most of the equipment needed will be supplied in the near future. New Zealand will not, however, be able to supply the additional troops needed for the island of Vanua Levu.

8. We are informed that, owing to the scarcity of troops for home defense in the absence of four divisions overseas, Australia is unable to increase the small garrison of one company now in New Caledonia within the next six months. Equipment is needed for the 3,700 Free French Forces in the island. Australia is laying minefields in the approaches to Noumea and Tontouta. The present Australian-Free French forces, however, are insufficient to secure the island against a determined Japanese attack.

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Recommendations.

9. (a) That the United States arrange for the local defense of Palmyra, Christmas, Canton, American Samoa and Bora Bora.

(b) That the United States arrange for such defense of islands in the Samoan group as is essential to the proper defense of the United States naval station and air fields in American Samoa.

(c) That the Dominion of New Zealand be responsible for the local defense of the Fiji Islands.

(d) That the Australian Commonwealth be responsible for the local defense of New Caledonia.

(e) That the United States assist in providing equipment and air defenses for the Fiji Islands and New Caledonia.

(f) That Australia and New Zealand afford all practicable logistic support to United States forces which may be assigned to assist in the defense of the Fijis and New Caledonia.

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COPY NO .....10.....
WASHINGTON, D.C.
January, 1942.

MOVEMENTS AND PROJECTS IN THE ATLANTIC THEATRE

First Half of 1942

1. We have carried out a study of the relative importance and inter relation of the various military movements and projects which affect the Atlantic Theatre and which may be required to give effect to the agreed Grand Strategy during the first part of 1942 and submit our conclusions below.

MOVEMENTS AND RELIEFS

2. Iceland and Ireland

We consider that the move of the United States forces into Northern Ireland and the relief of the British Iceland garrison should proceed as expeditiously as possible in order to relieve British Divisions for the replacement of Australian Divisions in the Middle East and to release forces for operation "Gymnast". Part 1 (a)

3. These moves to Iceland & Ireland will have little effect on British W.S. movement, as the bulk will be carried in the monster liners and the balance in U.S. ships and in Home coning British W.S. ships diverted from the C... e to Halifax.

4. The early movement of United States Army Air Forces to the United Kingdom should proceed as soon as these forces become available so as to increase the weight of attack on Germany.

5. Relief of Aruba and Curacao

The relief of Aruba and Curacao is already arranged and, subject to Dutch concurrence, is to be completed before the end of January.

JOINT UNITED STATES - BRITISH OCCUPATION OF FRENCH NORTH AFRICA

6. We regard this project as of the first strategical importance in the Atlantic area. We do not, however, possess the resources within the period under consideration to force an entry

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See Sheet 1 changes

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into French North Africa. We cannot therefore initiate this operation until we are reasonably sure of French co-operation or that there will be no more than sporadic resistance in the initial stages. During the period in which we await this opportunity we think that plans and preparations should be completed and that the movements referred to above should continue.

5. If the opportunity to undertake operation "Gymnast" occurs we consider that the strategic advantages to be gained are such that the operation should be launched despite the shortage of shipping and the implications on other movements. A preliminary examination of the shipping implications indicates that there will be a reduction of British/U.S. movements by 25,000 men, the suspension of operations "Pilgrim" and "Bonus" and a weakening of British strength in the United Kingdom. The movement of U.S. troops to Iceland will have to be postponed but the North Ireland moves can continue although at a slightly slower rate. It may be necessary to reduce British supplies of fighter aircraft to Russia.

6. CANARIES and PORTUGUESE ATLANTIC ISLANDS

Any move which results in German invasion of Spain will lead to the immediate denial of Gibraltar as a Naval Base and in all probability the involvement of Portugal as well as Spain in the war. In these circumstances it will be necessary to secure the Canaries as an alternative Naval Base. It is very possible that the Spaniards would themselves offer us facilities in the Canaries since they are unlikely to acquiesce fully in a German invasion of their mainland. In this case all that would have to be provided would be additional air and A.A. defences and harbour protection for the Naval Base.

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If we undertake operation "Gymnast" and the Spaniards subsequently acquiesce in a German move into Spain we could not at the same time undertake an operation to capture the Canaries. It would be necessary in this case to mask the Canaries until such time as forces became available for an operation for their reduction.

9. If the opportunity to carry out operation "Gymnast" does not occur and the Germans move into Spain with Spanish acquiesence the capture of the Canaries against opposition will become of first priority. It has been agreed that the responsibility for this operation is a British one, but it would probably be necessary to obtain Naval assistance from the United States. At least three large aircraft carriers will be required and these could not all be provided by the British in the near future. A British assaulting force is already earmarked for this operation and should, we consider, be kept in being.

10. In the event of a German move into the Iberian Peninsula it is almost certain that Portugal will admit British forces into the Azores. For the security of these islands the chief requirement will be air and anti-aircraft defences and harbour protection. The provision of these forces is a British responsibility and the necessary forces should be earmarked. Considerable difficulty however will be found in providing the shipping for this operation simultaneously with Gymnast.

11. If the move of British forces to the Azores becomes possible we are of the opinion that a small United States occupying force should be sent to the Cape Verdes in order to make certain that these islands are denied to the enemy and secured for future use. The occupation of the Cape Verdes will be of considerable importance if we do not succeed in gaining entry into French North Africa and are compelled to undertake operations in French West Africa at a later date.

/OCCUPATION OF FRENCH WEST AFRICA

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OCCUPATION OF FRENCH WEST AFRICA

11. Failing an Allied occupation of French North Africa occupation of French West Africa becomes of primary importance. It is improbable that if we do not succeed in obtaining French co-operation in French North Africa we shall gain free entry into Dakar. It is therefore necessary to plan the capture of French West Africa against opposition. With the joint resources available it is not, in our opinion, possible to undertake an operation of this nature until the late Autumn of 1942 when the weather conditions become favourable. It has been agreed that the United States should be responsible for this operation and we suggest that the planning and training should be put in hand. We propose for consideration that as a preliminary U.S. Pursuit squadrons should be moved to Freetown. Their presence in this area will increase the security of the Trans-African Reinforcement Route and the naval base at Freetown. They will also be in a position to move rapidly to French North Africa for operation Gymnast if French co-operation is secured.

NORTH EAST BRAZIL

12. The security of North East Brazil is of strategic importance as a link in the communications between America and the Trans-African reinforcement route. We consider that plans should be put in hand to carry out this operation if we fail to secure an entry into French North Africa and if the French agree to the movement of German forces into French North Africa. The operation is a United States responsibility.

DIEGO SUAREZ

13. Although the denial of the naval base of Diego Suarez to the enemy is of considerable strategic importance, no British force will be available to undertake this operation within the

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under consideration if the force for operation "Pilgrim" is kept in being. Moreover, if this operation were carried out in the near future it might prejudice our chance of obtaining French collaboration in North Africa. We are therefore of the opinion that we cannot hold a force ready to undertake this operation at present.

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January 8, 1942.

MEMORANDUM FOR COLONEL GEROW:

Subject: Meeting of the Joint Planning Committee.

The Joint Planning Committee will meet, at the request of the British members, at 3 p.m. today instead of the previously announced 10 a.m. this morning.

The British desire to take up at this meeting the subject of Defense of the Pacific Islands Route. Their draft paper on this subject is forwarded herewith.

W. P. SCOBEY,
Colonel, General Staff, U.S.A.
Secretary.

1 Incl.
British draft
paper as above.

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2ND REVISE.

JOINT PLANNING COMMITTEE

DRAFT REPORT FOR THE CHIEFS OF STAFF COMMITTEE

Subject: Defence of Pacific Islands Route.

1. When approving the Joint Planning Committee's Report on "Supporting Measures for the South West Pacific" (ABC-4/3), the U.S. and British Chiefs of Staff noted that the reinforcement of Fiji and New Zealand was being separately considered. On examination of this problem the Joint Planning Committee found that it was not practicable to deal with Fiji in isolation without reference to the other points on the air routes from Hawaii to Australia, and to the Naval bases in the Pacific Islands.

Islands on the Air Route.

2. There is under development and approaching completion an air route suitable for the use of both long and medium range aircraft and extending from Hawaii to Australia. Airdromes are located at Palmyra, Christmas, Canton, American Samoa, Fiji and New Caledonia. In addition to their use as staging points along the air route, all of these islands are valuable components of the defences of the Hawaiian Islands or of New Zealand and Australia. They will serve also as operations bases for naval and air forces.

New Caledonia.

3. In addition to its military importance, New Caledonia is an important Japanese objective since it is the principal readily accessible source of supply for

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nickel of which the Japanese have at present only a limited supply. At present the total output of nickel is shipped to the United States. In emergency this source of supply could be denied to the Japanese for some time by the destruction of the blast furnaces, power supply and limited loading facilities.

Bora Bora.

4. It is planned also to establish at Bora Bora, in the Society Islands, a base for refuelling naval vessels and other shipping en route to and from the South West Pacific.

Scale of Japanese Attack.

5. It is estimated that the Japanese have in transports in the Marshall Islands approximately one infantry division, and that the bulk of the force used in the capture of Wake Island is also available for operations south and southwest of Hawaii. It is considered that Japanese forces of at least this strength supported by strong naval task forces, including two or more carriers, can launch simultaneous attacks on two of the island bases in early January. There are estimated to be two more divisions available in Formosa, but the availability of adequate shipping to permit their early use in the area is questionable.

Scale of Defence.

6. The defence of all the island positions along the route depends ultimately upon their support by naval forces. The strength of their garrisons should be made adequate to hold them for the length of time which may elapse before naval support can be made effective.

The present garrisons of the island bases are inadequate to hold out unsupported against the attacks of which the Japanese are capable. The degree of resistance to the Japanese of the French and native troops in New Caledonia is unknown.

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nickel of which the Japanese have at present only a limited supply. At present the total output of nickel is shipped to the United States. In emergency this source of supply could be denied to the Japanese for some time by the destruction of the blast furnaces, power supply and limited loading facilities.

Bora Bora.

4. It is planned also to establish at Bora Bora, in the Society Islands, a base for refuelling naval vessels and other shipping en route to and from the South West Pacific.

Scale of Japanese Attack.

5. It is estimated that the Japanese have in transports in the Marshall Islands approximately one infantry division, and that the bulk of the force used in the capture of Wake Island is also available for operations south and southwest of Hawaii. It is considered that Japanese forces of at least this strength supported by strong naval task forces, including two or more carriers, can launch simultaneous attacks on two of the island bases in early January. There are estimated to be two more divisions available in Formosa, but the availability of adequate shipping to permit their early use in the area is questionable.

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7. While the United States are able to provide sufficient forces for the defence of Palmyra, Christmas, Canton, American Samoa and Bora Bora, the attached table shows forces present in the islands, en route and planned to be sent in the future as shipping and naval escorts become available. The table also shows further measures to meet ultimate requirements.

Fiji.

8. New Zealand is sending all the personnel needed for the defence of Viti Levu, the U.S. providing very considerable quantities of the equipment required for them, the remainder being supplied from British sources. Most of the equipment demanded is being supplied in the near future.

New Zealand will not, however, be able to supply the additional two battalions required for the islands of Vanua Levu.

New Caledonia.

9. We are informed that, owing to the scarcity of troops for home defence in the absence of four divisions overseas, Australia is unable to increase the small garrison of one company now in New Caledonia within the next six months. Equipment is being provided by
for the 3,700 Free French Forces in the island and Australia is laying minefields in the approaches to Noumea and Tontouta. The present Australian-Free French forces, however, are insufficient to secure the island against a determined Japanese attack.

Recommendations.

10. (a) That the United States arrange for the local defence of Palmyra, Christmas, Canton, American Samoa and Bora Bora.

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(b) That the United States arrange for such defence of islands in the Samoan group as is essential to the proper defence of the United States naval station and air fields in American Samoa.

(c) That the Dominion of New Zealand should be primarily responsible for the local defence of the Fiji Islands, Viti Levu taking precedence over Vanua Levu.

(d) (Provision of additional forces for New Caledonia to be decided at the meeting).

Arrangements should be made for the demolition, if necessary, of the furnaces and power plant of the nickel mines and the loading facilities for chrome and nickel ore.

(e) When consideration is given to the general allocation of naval forces of the United Powers and the tasks assigned to them, due weight should be given to the dependence of the islands on naval support. Their need for naval support is all the greater while their local defences are being completed.

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DEFENCE OF PACIFIC ISLANDS ROUTE.

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	PLACE.	DEFENCES NOW THERE OR BEING SENT SHORTLY.	ADDITIONAL DEFENCE MEASURES RECOMMENDED IN IMMEDIATE FUTURE.	ESTIMATED DESIRABLE ~~FURTHER MEASURES MEET ULTIMATE REQUIREMENTS~~. GARRISON	REMARKS.
	(a)	(b)	(c)	(d)	(e)
1.	NEW CALEDONIA	One Company A.I.F. 3,700 Free French Forces (inadequately equipped) 2 6" Fixed Defence guns Base for sea planes and land planes but no aircraft.	Equipment for Free French Forces. 1 Regt. Inf. 1 Bn. F.A., Light Gun 1 Co. Engineers. (c) 1 Co. Tanks (L) 1 Bn. 37 mm. Gun (AA) Semi-mobile. 1 Btry. 155 mm. Gun.	1 Division, Inf. 1 Brig. CA(AA) 1 Bn. 155 mm Gun 2 Pursuit Groups (I) NOTE: Above less column (c) 1 PG. — 80 2 B/M Sq. 26 106	(40)
2.	FIJI	FOR VITI LEVU 6 New Zealand Infantry Battalions * 1 Regular Fiji Battalion (1/3 European) 1 Territorial Fiji Battalion (1/3 European) 28 Field Guns 120 Home Guards One 2 gun 6" Battery at Suva, one 2 gun 6" Battery at Momi. One 2 gun 4.7" Battery covering Suva entrance from West. All above have their ancillery troops. 100 tons barbed wire,	FOR VITI LEVU ARMY. 2 Bns. Inf. 1 Btry. CA 155 mm Gun. ✓ 1 Sect. Battery S/L. ✓ 1 Btry. CA, 37 mm Gun (AA) ✓ Equipment to bring forces in (b) to full equipment. ø 1 or 2 Tank Sqns. 1 Motorised Btn. 14 3" A.A. guns — 10 reg 120 Anti-tank rifles 12 Anti-tank guns.** 4 C.A. searchlights. NAVAL. 1 small minelayer 300 mines.	FOR VANUA LEVU 2 Bns. Inf. A.T. & A.A. weapons Force of A.F.Vs. 9 3" Mortars. FOR VITI LEVU 1 Bomber Recce. Sqn. (12) 9 3" mortars. 2 6" Coast defence guns	* 3 partiall equipped 3 unequipp ✓ already al ø Rifles & l automatics allocated. ** 6 already ated.

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(b)	(c)	(d)	(e)
y A.I.F. French Forces dequately equipped) d Defence guns r sea planes and anes but no aircraft.	Equipment for Free French Forces. 1 Regt. Inf. 1 Bn. F.A., Light Gun 1 Co. Engineers. (c) 1 Co. Tanks (L) 1 Bn. 37 mm. Gun (AA) Semi-mobile. 1 Btry. 155 mm. Gun.	1 Division, Inf. 1 Brig. CA(AA) 1 Bn. 155 mm Gun 2 Pursuit Groups (I) NOTE: Above less column (c) 1 PG — 80 2 B/M Sq. 26/106 (140)	
I LEVU	FOR VITI LEVU ARMY.	FOR VANUA LEVU	
and Infantry ns * Fiji Battalion opean) ial Fiji Battalion opean) ns rds Battery one 2 gun 6" t Momi. One " Battery Suva entrance from ll above have their troops. ed wire,	2 Bns. Inf. 1 Btry. CA 155 mm Gun. ✓ 1 Sect. Battery S/L. ✓ 1 Btry. CA, 37 mm Gun (AA). ✓ Equipment to bring forces in (b) to full equipment. ø 1 or 2 Tank Sqns. 1 Motorised Btn. 14 3" A.A. guns — 1 Reg 120 Anti-tank rifles 12 Anti-tank guns.** 4 C.A. searchlights. NAVAL. 1 small minelayer 300 mines.	2 Bns. Inf. A.T. & A.A. weapons Force of A.F.Vs. 9 3" Mortars. FOR VITI LEVU 1 Bomber Recce. Sqn. (IV) 9 3" mortars. 2 6" Coast defence guns	* 3 partially equipped. 3 unequipped. ✓ already allocated ø Rifles & light automatics already allocated. ** 6 already allocated.

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	PLACE.	DEFENCES NOW THERE OR BEING SENT SHORTLY.	ADDITIONAL DEFENCE MEASURES RECOMMENDED IN IMMEDIATE FUTURE.	FURTHER MEASURES MEET ULTIMATE REQUIREMENTS	REMARKS.
	(a)	(b)	(c)	(d)	(e)
	FIJI (contd:)	2 60 pounder 2 6" howitzer 4 Bofors 4 3" A.A. guns. 6 A.A. Searchlights. 1 Minesweeper 9 Reconnaissance Bombers. 9 Miscellaneous Aircraft. 4 Singapore Flying Boats. 25 P. 39 Fighters. 700 Men, U.S. Army Air Corps. 2 sets RADAR.	AIR. 1 Bomber Reconnaissance Squadron. 1 Flying Boat Squadron 2 sets RADAR. (See Above) (Preceding Page.)	(See Above) (Preceding Page).	(See Above) (Preceding
3.	SAMOA.	4 6" guns. 18 3" A.A. guns. 42 .50 M.G's. 42 .30 M.G's. 415 Marines. 150 Samoan Marines. 1 Regiment of Marines. 1 Bn. 75 mm (12 guns) 1 Coy. Light Tanks Hq.'s Troops. 6 5" guns. Total - 5,015 U.S. Marines.	None.	None.	

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S NOW THERE OR BEING NT SHORTLY.	ADDITIONAL DEFENCE MEASURES RECOMMENDED IN IMMEDIATE FUTURE.	FURTHER MEASURES MEET ULTIMATE REQUIREMENTS	REMARKS.
(b)	(c)	(d)	(e)
nder itzer . guns. earchlights. eeper aissance Bombers. laneous Aircraft. ore Flying Boats. Fighters. .S. Army Air Corps. ADAR.	AIR. 1 Bomber Reconnaissance Squadron. 1 Flying Boat Squadron 2 sets RADAR. (See Above) (Preceding Page.)	(See Above) (Preceding Page).	(See Above) (Preceding Page).
s. . guns. G's. G's. s. Marines. nt of Marines. mm (12 guns) ight Tanks Troops. s. - 5,015 U.S. Marines.	Nche.	None.	

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	PLACE	DEFENCES NOW THERE OR BEING SENT SHORTLY	ADDITIONAL DEFENCE MEASURES RECOMMENDED IN IMMEDIATE FUTURE	FURTHER MEASURES MEET ULTUMATE REQUIREMENTS	RE
	(a)	(b)	(c)	(d)	
4.	CANTON	45 Engineers. 10 Medical and Communication 10 Artillery Personnel. 2 75 m.m. guns 12 Machine Guns	1 Btry. CA.(AA) gun, semi-mobile 1 Btry. CA (AA), 37mm gun " 2 Cos. Rifle 1 - SCR 270	None	
5.	CHRISTMAS ISLAND.	125 Engineers, Medical and Signal Personnel 10 Artillery Personnel 12 Machine Guns 4 3" A.A. guns 2 75 m.m. guns 2 155 m.m. guns	1 Btry. CA (AA) gun, semi-mobile 1 " CA (AA) 37mm " " 1 Plat. CA (AA),SL 1 Bn. Inf. Rifle W/ATT Med. 1 SCR 270 2 5" Cal. 51" Navy guns plus 6 Cal. 30 Mgs. & 36 Cal. 30 Mgs.	None	
6.	PALMYRA	162 Marines 4 5" guns 4 3" A.A. guns 8 .50 A.A. Machine Guns. 8 .30 A.A. Machine Guns.	None The Marine Det. should be replaced by an Army Force of same no. and type.	None	
7.	BORABORA	None	1 Marine Defence Bn. 1 Bn. Inf. Rifle, Army	None	Marine includ 8 - 7" 12 - 3" 30 -.50 30 -.30 1 - SC 3 - SC

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NOW THERE OR BEING SHORTLY	ADDITIONAL DEFENCE MEASURES RECOMMENDED IN IMMEDIATE FUTURE	FURTHER MEASURES MEET ULTUMATE REQUIREMENTS	REMARKS
(b)	(c)	(d)	(e)
rs. and Communication ry Personnel. guns Guns	1 Btry. CA.(AA) gun, semi-mobile 1 Btry. CA (AA), 37mm gun " 2 Cos. Rifle 1 - SCR 270	None	
rs, Medical and Personnel ry Personnel Guns guns guns guns	1 Btry. CA (AA) gun, semi-mobile 1 " CA (AA) 37mm " " 1 Plat. CA (AA),SL 1 Bn. Inf. Rifle W/ATT Med. 1 SCR 270 2 5" Cal. 51" Navy guns plus 8 Cal. 30 Mgs. & 36 Cal. 30 Mgs.	None	
s s . guns A. Machine Guns. A. Machine Guns.	None The Marine Det. should be replaced by an Army Force of same no. and type.	None	
	1 Marine Defence Bn. 1 Bn. Inf. Rifle, Army	None	Marine Defence Bn. includes: 8 - 7" Navy guns 12 - 3" AA guns 30 -.50 Cal. mgs. 30 -.30 Cal. mgs. 1 - SCR 270 3 - SCR 268

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S E C R E T

U.S. Serial ABC-4/CS2

COPY NO. 34

Washington
January 7, 1942.

MEMORANDUM FOR THE BRITISH
CHIEFS OF STAFF

Subject: Immediate Assistant to China.

1. The United States War Department has been exploring methods of increasing assistance to China so that better effect might be realized from utilization of that country's resources against Japan. Information, currently available, seems to indicate a definite and progressive weakening, morally and materially, in China's war effort. The War Department regards it as of profound importance that such steps as may be practicable and are consistent with other commitments be promptly taken to reverse this trend.

2. The chief obstacle to producing a better military result in China, aside from a general scarcity of munitions, is that country's almost complete isolation. Communication with the Generalissimo is difficult and subject to delay and possible interception. The long, poorly maintained and insecure Burma Road can, at the best, support only a limited truck-tonnage, --- while air raids, confusion and lack of coordination at Rangoon further limit the amounts of supplies possible to deliver to the Chinese. Several things are indicated as necessary:

(a) Closer and more effective liaison with the Generalissimo.

(b) Increased security for Rangoon and the Burma Road, by air and ground.

(c) Improvement in the control, maintenance, and management of the Burma Road.

(d) Increase in base facilities and technical services.

(e) Increase in Chinese combat strength resulting from above measures.

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(f) Close and effective liaison between China and the Commanding General, ABDA Area.

3. The War Department is considering initiation of the following steps to meet the requirements listed in paragraph 2:

a. Arrange with the Generalissimo to accept Lt. Gen. Hugh A. Drum as the U.S. Military Representative at his capital, and to agree to the following as General Drum's functions:

(1) Supervise and control all Lease-Lend affairs for China.

(2) Command all U.S. Forces in China, and, under General Wavell, to command all U.S. and Chinese forces in Burma.

(3) Represent the U.S. Army on any International War Council in China.

(4) Control and maintain the Burma Road, in China.

(Note: The following are projected upon the condition that a is, in its entirety, previously accepted by the Generalissimo.)

b. Dispatch to the South China -- Burma area additional aviation strength, initially raising and maintaining the A.V.G. at war strength in planes and personnel. In addition, it is considered possible that, through special emphasis in Lease-Lend operations, several Chinese divisions may be quickly equipped for effective combat service in this area, under General Drum's command.

c. Arrange, (with the consent of the British) for auxiliary bases in support of the Chinese effort, and provide the technical troops to assure the efficiency of such Rangoon facilities as are allocated to China, and to assist in the maintenance of the Burma Road.

4. To make this project reasonably effective, British cooperation and agreement are required on the points set forth

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hereinafter. It is understood that British agreement and cooperation will become effective only in the event that the Generalissimo accords to Gen. Drum the authority implied and indicated in par. 3 a above.

Points on which British Agreement is sought, under conditions stated in paragraph 3 a

a. General Drum to be permitted to establish supply bases and staging areas in Calcutta and Rangoon to support his operations in and north of Burma.

b. General Drum to be authorized to assume control and maintenance of the Burma Road from Rangoon to Chungking.

c. General Drum to be permitted use of necessary airfields in Burma.

d. General Drum's command of American and/or Chinese forces in the Burma region to be exercised under the control of General Wavell, but such forces to be used only on the mainland of Asia, exclusive of Malay. General Drum to exercise, as a subordinate of General Wavell's, any additional command functions, territorial or otherwise, as Gen. Wavell may desire, provided that he is not required to leave the general area of Burma -- China -- Calcutta.

e. General Drum to be accepted as the liaison agency between General Wavell and Generalissimo Chiang-Kai-shek.

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CONFERENCE NOTES 1/8/42

SUBJECT: Aircraft preference ratings

PRESENT: OUSW - Mr. Lovett
OCAC - Col. G. Gardner
AAF/AS-Lt. Col. E.C. Langmead

Mr. Lovett: Reviewed history of aircraft preference ratings

Mr. Lovett: Outlined highlights of discussion on Sunday, January 4, 1942 with Secretary Gates of Navy Dept.

Mr. Lovett: After allowing 100 airplanes for 1 carrier per month in 1943, there does not seem to be any likelihood of shortage of Navy airplanes in 1943. Each carrier will require three or four types; hence the the indicated basic requirement is for 25 airplanes of each type per month for carrier outfitting.

Mr. Lovett: Instructed preparation of letter to the ANMB: "Requirements for aircraft are so urgent that we need greater preferential treatment for machine tools and materials. We cannot agree to any revision of preference ratings or of the Master Preference List (for machine tools) which will result in dilution or subordination of our present position. When and if any change is contemplated, we must be given an opportunity to plead the case for the aircraft industry.

Langmead: Three actions affecting the preference position of the aircraft industry are in process:

a. ANMB - Revision of Master Preference List (for machine tools). Action apparently initiated by the Bureau of Ordnance and Ordnance Department to subordinate the heavy bomber program.

b. ANMB- Consideration of revision of preference rating list to include all aircraft in A-1-A. Action initiated by Bureau of Aeronautics to get all Navy airplanes on a par with heavy bombers.

c. Joint Aircraft Committee- Consideration of revision of relative rank list of aircraft within the aircraft industry. Action initiated by scheduling unit of OPM to secure advantage of a directive based on latest strategical concepts.

Gardner: Discussed JAC Subcommittee plan for revising the airplane relative rank list.

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Group I. Rearrange alphabetically by company name and add in Lancaster.

Group II. Move in C-47 Douglas transport
Move down B-26, AT-9,10,11.

Group III. Move in P-40E from Group V
Move down P-38 to Group V.

Langmead: To keep the system operative, we must have down one type equivalent (from a production standpoint) to the type we move up.

Mr. Lovett: In view of the President's directive, we must:

a. Move the B- 5 up from Group IV
b. Keep the B-26 in Group II
c. Move the P-40E up.
d. Pull the Hudsons down.
e. Await Echols decision on the P-38
f. Keep service combat (transport and observation) below the combat types (pursuits and bombers)

Gardner: The relative rank list will be restudied in the subcommittee before presenting a recommendation to the Joint Aircraft Committee.

Langmead: Presented argument in favor of a relative rank list for all the munitions covered by the President's directive, following the pattern of the aircraft relative rank list. Such a list will be a guide as to the sequence for establishing facilities. Deficiencies of equipment and material will fall heaviest on the item of lowest relative importance.

Langmead: It is not practical to bring in production for the new program in phase for all items. All items are not needed at the same time or to the same degree.

Langmead: Proposed that the entire machine tool industry be devoted to bringing in complete plants in sequence based on the relative urgency of the item.

NOTE: These notes are not intended to be an official record. They are intended to serve the individuals present as a reminder of the topics discussed.

E.D. Langmead, A-4

Copies to:
Mr. Lovett
Col. Gardner
Gen. Echols / Lt. Col. Langmead
Col. Hanley

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We consider that it is important to provide some defenses in the island as early as possible. The only way to do this would be for the United States to send the necessary force. These forces would, however, initially be at the expense of the AMDA force. An opinion should also be obtained ~~xxx~~ from Australia as to the priority for arming the 3700 Free French on the island. A list has been received of their requirements.

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(e) That the defense of New Caledonia should in principle be accepted as an Australian responsibility, but that the United States should as a temporary measure furnish forces as early as possible for the defense of the island, even if this has to be at the expense initially of the ABDA area. The question of arming the Free French troops should be taken up between the United States and British Staffs as soon as an opinion has been obtained from Australia as to the priority.

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K M W/aa

Written 1/1/42

MEMORANDUM for General Arnold.

Subject: Joint American-British Occupation of French North Africa.

1. Strategic Aspects.

1. Careful examination indicates the joint American-British occupation by invitation of French North Africa to have the following advantages:

a. Facilitates American-British control of the western Mediterranean and may open to restricted use, the short shipping route to the Near East.

b. Forestalls German action in this area.

c. Provides air bases for immediate bomber operations against Italy; future bomber operations against Germany, and concurrently a base for future land operations against the Axis Powers.

d. Stops flow of raw materials to Germany from and through this area.

e. Covers the Dakar area, preventing or making most difficult reinforcements by sea and air of that area. Hence, the occupation of French North Africa accomplishes to a large extent the advantages to be gained in the occupation of West Africa.

f. Successful occupation of French North Africa should have an advantageous morale effect, particularly in those countries now subjugated by Germany.

2. It is clear that if a successful occupation upon invitation is accomplished, all of the advantages listed above will accrue thereto. However, it is essential to consider what disadvantages would result from an unsuccessful attempt to occupy or to hold North Africa.

3. The disadvantages are discussed in comparison with the advantages listed in the first paragraph.

a. Control of Western Mediterranean and opening to restricted use the short shipping route to the Near East. Failure of the project resulting in stiffening both the Spanish and Vichy French opposition to the Allies, combined perhaps with the occupation of key

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points in Tunisia, Algeria and Morocco by German forces, would doubtless result in complete closing of the very limited route now open to Malta. (It is understood that the British have moved supplies by sea in limited quantities through the Western Mediterranean.

b. Forestalling German action in this area.

So long as Vichy-France maintains a favorable attitude towards Germany, it is possible that the German will not take any major action to secure this area with German forces, particularly in view of German commitments elsewhere. Germany will probably depend upon the French to hold this area. Failure of an attempt to occupy and hold North Africa would doubtless bring in German forces. Therefore, any possible future A-B operations to secure this area, when the situation might be favorable, would be far more difficult. In substance, while a successful occupation would forestall German action in this area, an unsuccessful operation would commit the Germans to positive action in this area. It would then be difficult to dislodge them.

c. Providing bases for immediate operations against Italy and for future operations against Germany.

Successful occupation would provide these advantages through securing and improving air bases and related facilities. Failure would result in turning over to the Germans, air bases from which they could operate against the British to the east and against any American forces which might move into West Africa.

d. Stopping flow of raw materials to Germany from and through this area.

An unsuccessful occupation would result in more positive German control over this area. Therefore, the Germans might exploit the sources of what raw materials which may be shipped from this area, and thus increase what advantage they now have in this respect.

e. Covering the Dakar area.

Defeat of the A-B forces would be most likely to prove most disastrous to alternative operations involving the seizure of Dakar, the Cape Verde Islands, and the contiguous areas. Forces now available are insufficient to permit simultaneous operations against both French North and West Africa. Coincident with or immediately following German success against American-British forces in North Africa would certainly be the reinforcement of Dakar or occupation by German forces. American-British forces could not hope to withdraw from French North Africa and move into Dakar, to forestall hostile action, nor would available shipping and forces in the United States permit an offensive to be launched against Dakar immediately following the failure of an American-British occupation of French North Africa. It is clear that the Nazis could speedily reinforce Dakar. To

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forestall American action in French West Africa, it would not be unlikely that the Nazis would move the equivalent of one or two heavy bombardment groups to the Dakar area. Such a force, together with the French aircraft already in that area, would make the operation against the Cape Verdes or Dakar extremely hazardous. Furthermore, such aircraft could easily operate against our bases in Freetown and in Monrovia. It is the considered opinion that failure of the North African expedition would result concurrently in securing West Africa. This might be disastrous to British strategy in the Middle East. Air lines of communication through Middle Africa would be cut. Sea lines of communication would be seriously interdicted by Nazi or French submarines operating from Dakar. This result must be viewed in all of its grave significance.

f. Advantageous morale effect in all countries.

A successful occupation of French North Africa would have a marked morale effect in all nations, particularly those now subject to German rule. The diametrically opposed result could well attend failure. First, the subject countries might view with grave alarm the weakness of American arms when opposed by the Nazis. Second, it might indicate that the United States is so ill prepared that it cannot at this time or for sometime in the future send any effective forces against Germany. This might do much to strengthen the French-German link. Spain, (doubtless desiring to be on the winning side) might be impressed with the fact that the United States will not be a major opponent for several years and in the interim the Nazis might gain complete domination in Europe. Those countries which will have viewed with acclaim, initiation of American-British operations in French North Africa could only gain a feeling of hopelessness, in that American arms should fail in its initial offensive action. The result might be to restrict further continued undercover opposition to the Nazis in the conquered countries.

4. An invitation by the French to occupy French North Africa must be examined in a critical light. Plans for the occupation should not dismiss the high probability that the German will be informed of this invitation. Certainly, around conference tables of the French where the invitation is discussed, there is certain to be opposition. Those representing the opposition are probably of Nazi leanings. If this is true, the occupation will not be a surprise to the Germans and if they view with importance the seizure of this area by A-B Powers, they will take action to block it. This is particularly true because it appears or would appear to great advantage to the Germans to defeat the Americans in their first offensive this Powers.

5. In view of the disadvantages accruing to an unsuccessful occupation of French North Africa with the defeat of joint American-British forces, it follows that the operation must be conducted with that

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force in that manner that will afford a reasonable chance of success. In the event that the Germans are aware of the invitation and take action to meet it, and in the further event that the forces committed to this action are below that minimum deemed essential for a successful operation, we will have another example of having arrived too late with too little. The operation must be viewed as involving only a calculated risk and not a desperate gamble; the forces involved and their employment must be predicated upon such a premise.

6. The following estimate of the situation discusses in detail the operation and the forces believed essential for its accomplishment.

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U.S. SERIAL ABC-4/4
British Serial W.W. (J.P.C.)4

Washington, D. C.
December 28, 1941

PROPOSED TASKS FOR THE JOINT PLANNING COMMITTEE

1. A study of the relative importance and inter-relation of the various military projects and movements which affect the Atlantic theatre and which may be required to give effect to the agreed Grand Strategy during the first part of 1942.

This report will include consideration of the following:

A. Movements

(a) Relief of Iceland

(b) Movement of three Divisions and one Armored Division from the United States to Northern Ireland.

(c) Movement of U.S. air forces to the United Kingdom.

(d) Relief of British in Aruba and Curacao.

B. Projects

(a) Joint U.S. - British occupation of French North Africa.

(b) United States occupation of:

(1) French West Africa and Cape Verde Islands.

(2) Northeast Brazil.

(c) British occupation of:

(1) The Azores.

(2) The Canaries and Madeira

(3) Diego Suarez

2. Coordination of the Victory Programmes of the United States and the British Commonwealth and adjustment of their broad outlines in accordance with strategic considerations and production possibilities.

3. A consideration of any steps that should be taken in the light of experiences up to date to implement, improve, or extend the system of collaboration between the United States - British Staffs as laid down in ABC-1; the need for allocating joint resources on a strategic basis to be taken into account.

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WAR DEPARTMENT
WAR DEPARTMENT GENERAL STAFF
WAR PLANS DIVISION
WASHINGTON

December 31, 1941

MEMORANDUM FOR LIEUT. COLONEL WALKER, AIR CORPS, WPD:

Subject: Review for Period First Half of 1942 of Allied Strategy in the Atlantic Theatre.

1. Forwarded herewith is a revised copy of the paper on the above subject, which was the topic of our discussion this morning.

2. It is requested that this paper, together with your comments, be returned to the Plans Group, War Plans Division, as early as practicable.

E. J. ROGERS, JR.,
Major, G.S.C.

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Air Forces:

+1 Group, Bomb (H)	35 Aircraft
1 Group, Bomb (M)	57 "
1 Group, Bomb (L)	57 "
2 Groups, Pur (F)	160 "
+1 Group, Observation	
Avn Services	
	"
Total Air Forces	29,000

Air Forces:

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U.S. SECRET

Review for period first half of 1942
of Allied Strategy in Atlantic Theatre.

INTRODUCTION

1. The projects and movements affecting the Atlantic Theatre required in the first half of 1942 to give effect to the agreed grand strategy are closely inter-related. The limitations both in regard to forces and to shipping available accentuate this inter-relation and call for careful review of the programme as a whole and of the relative importance of individual items.

2. It will be convenient to consider the items under two main headings:-

(a) Movements and reliefs under our own control which are not necessarily affected by the enemy's operations other than his normal attempts to interfere with communications;

(b) Projects which are dependent on outside factors, both political and arising from enemy action.

3. It must be remembered that throughout the preparations for these moves and amphibious projects the Battle of the Atlantic and the main bomber offensive against Germany must be maintained and intensified. The Middle East and Far East Theatres must also be maintained and supplies continue to Russia both via Archangel and the Persian Gulf. Shipping to meet these fundamental requirements will have to be allowed for when assessing total availability of shipping for the reliefs and projects affecting the Atlantic Theatre dealt with in this paper. In addition personnel and materiel will require to be withheld for the necessary expansion of training facilities and production to meet requirements of the Victory Programme.

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MOVEMENTS

Relief of Iceland

4. The present arrangement under which Iceland is garrisoned partially by American and partially by British forces is unsatisfactory and uneconomical. It is desirable that the responsibility for providing the garrison of Iceland should be assumed by one power as early as possible.

5. The relief of the existing British garrison would have the advantage of relieving for operations elsewhere one fully trained Division. This Division is urgently required in the United Kingdom towards replacing the deficiencies in anti-invasion forces caused by the despatch or earmarking of troops for overseas operations.

6. Included in the existing American Garrison is a Marine formation highly trained in amphibious warfare which is urgently needed for active operations elsewhere.

Movement of three Divisions and one Armoured Division from the United States to Northern Ireland.

7. The movement of three American Divisions and one American armoured division to Northern Ireland would have the following advantages:-

(a) It makes two fully trained infantry Divisions immediately available for active operations;

(b) By raising the overall strength of the garrison it increases security against invasion;

(c) The arrival of a considerable body of American troops in Ireland will have a marked moral effect in Europe.

Movement of United States Air Forces to the United Kingdom

8. The movement of United States Air Forces to the United Kingdom will have similar advantages to those referred to in 7 (b) and (c) above and will be an invaluable addition to the main bombing offensive against Germany.

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Relief of British in Aruba and Curacao.

9. The allocation of American troops for the defence of Aruba and Curacao releases about two battalions of British troops for use elsewhere. It also provides American troops for duties in an American strategic area.

PROJECTS

Joint American-British Occupation of French North Africa.

10. Joint American-British occupation by invitation of French North Africa will have the following advantages:-

(a) Forestalls German action in this Area;

(b) Stops flow of raw materials to Germany from and through this area;

(c) Facilitates A-B control of western Mediterranean and may open the restricted use of the short shipping route to the Near East;

(d) Provides bases for bomber operations against Italy and for future operations against Germany;

(e) Covers West Africa;

(f) Successful occupation of French North Africa will have a marked moral effect in all countries.

Provision of escorts for this operation and its subsequent maintenance will, however, reduce the scale of protection given to North Atlantic trade convoys.

11. The immediate results of A-B forces entering North Africa would probably be German occupation of the Iberian Peninsula and a demand from the French for support against a German threat to Tunisia. It is essential, therefore, to carry out the occupation in sufficient strength to meet both a German air and land threat based on Spain, possibly extending through Spanish Morocco, and also to occupy Tunisia as well as the coastal belt of Morocco and Algeria.

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12. The occupation by the Germans of Spain would neutralise Gibraltar and entail the occupation of the Canaries as an essential alternative. It will be necessary, therefore, to be ready to occupy the Canary Islands simultaneously with our entry into North Africa.

13. A German invasion of the Iberian Peninsula will increase the importance of the Azores and will probably entail provision of a token force to support the Portuguese in particular in the event of the Portuguese Government withdrawing to these islands.

14. A detailed study *of the forces required initially to occupy and hold North Africa show them to be of the order of:-

Ground Troops.	Air Forces.
One Amphibious Assault Division (Combat Loaded)	232 First Line Fighter Aircraft
Three Infantry Divisions	57 First line Medium bomber Aircraft
Two Armoured Divisions	57 First line light bomber Aircraft
144 Heavy A.A. Guns	39 First line Observation Aircraft.
252 Light A.A. Guns	
Base and L. of C. units	

15. The mounting of such an expedition involves a large proportion of available striking power and shipping. Political action to prepare the way for the operation must therefore be accurately timed, in order that the forces may be ready to move at the required moment. Delay in settling the political aspect will result in the forces and shipping being held ready but inoperative for an indefinite period.

American Occupation of French West Africa, Cape Verde Islands and North East Brazil.

16. The chief objects of these operations are to secure the sea routes between the North and South Atlantic and the air reinforcement route across the South Atlantic and Africa. If North Africa is successfully occupied by A-B forces occupation of West Africa and Cape Verde Islands becomes of less importance. But if the North African project fails or is forestalled by German action A-B

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occupation of West Africa will be essential even against opposition. Detailed plans must, therefore, be made now for these operations. Political and military action to safeguard the position in North East Brazil should, in the meantime, be completed as early and as economically as practicable.

17. Occupation of Dakar against opposition will be a major operation. The approximate forces required are as follows:-

Advance Force

Air Forces -	1 Group, Bomb (Hv) 1 Group, Bomb (M) 2 Groups, Pur (I) 1 Group Transport 1 Recon. Sq. (Hv) Avn Services	
Total Air Forces		26,500
Ground Forces -	4 Anti-aircraft regiments 1 Triangular division 2 Defence battalions	
Total (air and ground)		50,800
Naval Forces -	2 Battleships 2 Heavy cruisers 2 Light cruisers 2 Aircraft carriers 30 destroyers 1 Hospital Ship 144 Aircraft (carrier borne) 144 Patrol Planes.	

Main Force

Ground Forces -	2 Triangular divisions 1 Armoured division Supporting troops	
Total strength		75,000
Naval Forces -	2 Battleships 2 Heavy cruisers 6 Light cruisers 30 Destroyers 2 Aircraft carriers 12 Submarines 1 Hospital ship 144 Aircraft (Carrier borne)	

18. The forces required to occupy Dakar by invitation and hold it thereafter are of the order of:-

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Air	Army
160 Fighters	1 Infantry Division.
132 Medium Bombers	1 Armoured Division.
13 Transports.	2 A.A. Regiments.

~~23,000.~~ 68,000

British occupation of the Azores, Canaries and Madeira.

19. The occupation of the Canaries and Madeira will become necessary in the event of a German invasion of the Iberian Peninsula whether or not we have successfully occupied French North Africa or French West Africa.

The occupation of the Canaries coincident with our entry into French North Africa is referred to in paragraph 12 above, and from this it follows that it is necessary to earmark the forces for these two places additionalto those required for the North African project.

20. In the event of a German invasion of the Iberian Peninsula, we must be ready to send a token force to assist the Portuguese to hold the Azores.

If the occupation of Dakar is decided upon against opposition, it may be necessary to occupy the Cape Verde Islands as a preliminary operation. This will antagonise the Portuguese and, in such an event, we must be ready simultaneously to occupy the Azores against opposition.

In any case, the occupation of the Azores would not only deny them to the Germans, but ensure to us a valuable link in air and sea communications.

Diego Suarez.

21. Developments in the Far East may produce a Japanese threat to Madagascar. This threat could be forestalled by the occupation of Diego Suarez, which would, in any case, be a valuable base for our naval operations. Previous study has shown that the only

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forces and equipment suitable and available for this operation will have to be found from those required for the operations in the Atlantic referred to above. Thus a choice has to be made between denuding the forces required for the Atlantic theatre or indefinitely postponing the occupation of Diego Suarez.

CONCLUSION

22. We conclude that the relative strategic importance of the various projects is as follows:-

Present circumstances:

(1) North Africa, the Azores and Canaries.

(2) West Africa, the Azores, Cape Verde Islands and Diego Suarez.

(3) North East Brazil, the Canaries, the Azores and Cape Verde Islands.

In the event of German occupation of the Iberian Peninsula:-

(1) West Africa, the Azores, the Canaries and Cape Verde Islands.

(2) The Azores, Canaries and Cape Verde Islands.

23. The North African project is of first strategic importance. It is recommended that detailed preparatory measures, both for this major project and the lesser ones that go with it, be started at once.

24. Reliefs and movements best calculated to facilitate these preparations should be made as early as practicable. The first measures, therefore, should be to complete the detailed planning, collection and training of the American and British forces necessary for the occupation of North Africa, the Azores and the Canaries. As regards West Africa, detailed planning should be put in hand at once.

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25. In completing the balance of the Atlantic strategic programme for the first half of 1942, priority should be given to those movements which are most directly connected with preparations for the North African project.

26. On this basis we assess the priorities of movements as follows:-

(a) Relief of British garrison and American marines in Iceland by American troops.

(b) Relief of Ireland by U.S. troops.

(c) American Air Forces to United Kingdom.

(Relief of Aruba and Curacao is already arranged and, subject to Dutch concurrence, should be completed before the end of January).

27. It is desirable that, in view of the time factor, every effort should be made to initiate and maintain these moves coincident with the preparations for the main project in North Africa, the Azores and the Canaries.

28. The major projects included in the above strategic programme are dependent almost entirely on the attitude of the French. In the event of the French in North Africa adopting a hostile policy, the North African project will become impracticable. Moreover, the previous studies were based on the assumption that the Spanish would not actively assist the Germans or oppose us with more than token resistance.

From this it is evident that successful political preparation is fundamental to the whole of our Atlantic strategic programme for the first half of 1942.

WASHINGTON, D.C.

30th December, 1941.

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VICTORY
PROGRAM

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Copy No. 6
January 5, 1942

VICTORY REQUIREMENTS

1. In September 1941 the Planning Committee of the London Conference on Victory Requirements rendered a report.* This report was based upon the British Chiefs of Staff's view of future strategy and it contained an estimate of the ideal forces of all arms which the British considered necessary to ensure the fulfillment of their task in those areas of the world which were allocated to British strategic direction in ABC-1. By deducting from this total the large forces which the British Empire expected to raise in the future, a list of estimated British deficiencies was obtained. (* BH (41) 14.)

2. Similarly, acting on a directive of the President of the United States, on July 9, 1941, the War and Navy Departments undertook an exploration of the over-all production requirements required to defeat the potential enemies of the United States. The Army and Navy estimate of United States Over-All Production Requirements, dated September 11, 1941, contains production requirements for the United States and Associated Powers, but the examination of the target programs therein, in relation to the agreed Joint American-British strategy for the future conduct of the war, has not yet been undertaken.

3. Pending the early examination and revision of British and American target programs, and their combination into the total Victory Requirements of the Democratic Powers for the implementation of the agreed strategy, it is believed that they will serve, in their present form, as the basis for planning for expanded production, if agreement can be reached on the general order of priorities in the production program. It is essential that the phasing of this program should be planned to harmonize with agreed grand strategy.

4. Since it is not practicable to lay down absolute priorities, which would secure the completion of one part of this program to the exclusion of all others, there must be allocations of capacity which will secure the development in proper sequence of the succession of operations contemplated in our grand strategy. We must therefore provide in the early stages for the provision of the requirements of security, especially that of sea communications, and the provision of the necessary shipping. We must also provide at an early stage

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in the program, for the provision of land, sea and air forces, and war material necessary to close the ring around Germany and maintain our defensive position in the Far East. It must also be our aim to achieve the Heavy Bomber program in time to permit of the effective employment of the full weight of land and sea forces in the final stages.

5. In respect of 1942 production, it should be the aim to expedite, rather than to alter, the planned schedules of production in the United States and the British Empire, in order to avoid the serious retardations of production likely to ensue upon attempted changes. The expansion of production necessitated by the target programs should proceed concurrently with planned 1942 production, with no change in the latter except as dictated by the most urgent military considerations. Production in the United States for 1942 is proceeding in accordance with the programs given in Annex I.

6. The Joint American-British Planning Committee recommend:

a. That detailed study and definition of an American-British program of sea, land and air armaments, as required to implement the agreed grand strategy, and taking into account the material requirements of all Associated Powers, be undertaken at once by a joint committee appointed by the U. S. - British Chiefs of Staff, and reporting to them.

b. That the agreed American-British program be divided into American and British programs by the joint committee, and that the appropriate agency of each nation, aided by their respective production authorities, set up production programs which, by assignment of relative priorities and allocation of capacities, will harmonize with the agreed grand strategy.

c. That, pending the completion and approval, by the respective governments, of the American and British production programs, the U. S. Victory Program of September 11, 1941, subject to decision by the President of the United States as to the size of the various categories of the U. S. armed forces, shall be considered a general guide for long-range planning by the United States.

d. That the requirements listed in Annex I be met as far as possible from production in the United States in the calendar year 1942.

e. That, in consonance with the decision of the President of the United States, naval vessels, constructed in the United States for Associated Powers,

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be limited to the categories below:

Auxiliary Aircraft Carriers
Escort Vessels
Naval Coastal Frontier Forces
Landing Craft

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Annex I.

a. Air Forces. The present schedule of aircraft production of all types in the United States for 1942 is approximately 46,000 aircraft, of which 27,000 are combat type. The goal for 1942 production is approximately 50,000 aircraft, of which 30,000 would be of combat type. To date only 22,000 combat planes of this production during the various months of 1942 have been allocated by the Joint Aircraft Committee to the forces of the Associated Powers. This allocation will result by the end of that year in approximately 47% of the U. S. combat aircraft production becoming available to other than U. S. forces with 35% to the U. S. Army Air Forces and 18% to the U. S. Naval Air Forces. For the various months of 1942, this production must be allocated to the Associated Powers in accordance with the joint strategic plans. This allocation of production will provide the combat equipment of the following U. S. forces by the end of 1942:

(1) Army Air Forces. (Approximately 998,000 men)
115 Groups (Approximately 7,600 combat planes)(Does not include attrition and reserves)

Heavy Bomber	34 Groups
Medium Bomber	12 "
Light Bomber	10 "
Pursuit Interceptor	25 "
Pursuit Fighter	6 "
Photo & Obsn	16 "
Transport	12 "

(2) Naval Aircraft, ship or tender-based
(Includes Marine Corps planes)(Does not include attrition and reserves)

587 Fighters
499 Scout bombers
210 Torpedo and Torpedo bombers
387 Scout observation
131 Miscellaneous and utility
72 four-engine Patrol Planes
552 two-engine Patrol Planes
288 one-engine Inshore Patrol Planes
192 Misc. transport-utility types
84 Training Patrol Planes
3002 Total Operating U. S. Naval Aircraft.

b. Naval Forces. It is expected that the 1942 production will result in the following status of the U. S. Navy:

(1) Naval Personnel. (Approximately 700,000 men)

(2) Coast Guard, designated vessels and approximately 75,000 men.

(3) Marine Corps. Approximately 150,000 men.

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2 Marine Divisions
1 Separate Regiment (4th Marines)
26 Separate Battalions
15 Barrage Balloon Squadrons
Marine Corps Aircraft (listed with 1 a (2) above).

(4) Combatant Vessels.

20 Battleships (BB)
7 Aircraft Carriers (CV)
18 Heavy Cruisers (CA)
27 Light Cruisers (CL)
247 Destroyers (DD)
138 Submarines (SS)
16 Escort Carriers (AVG)

(5) Large Naval Auxiliaries - - - - 326

(6) Naval Coastal Frontier Forces - 679

(7) Naval District Utility Craft - 701

(8) Expansion of Naval Shore Establishments, dry-docks, ship-building facilities, etc., to meet present and future requirements.

Present production schedules now include numerous naval items to be produced in the U. S. for delivery to the Associated Powers. The allocation of this production will be made in accordance with joint strategic plans.

c. Land Forces. Present production schedules for equipment of land forces to be produced in the United States for the Associated Powers in 1942 are inadequate to meet predicted requirements. These requirements are based on organization of the U. S. forces shown below and stated requirements of the other Associated Powers. The allocation of this production during the various months of 1942 to the Associated Powers must be made in accordance with the joint strategic plans and the current availability of supplies. While it is understood that there will be inadequate equipment for these forces, the U. S. has as an objective the organization by the end of 1942 of the following land forces or their equivalent:

Land Forces. (Approximately 3,000,000 men)

39 Infantry Divisions (Foot)
6 Infantry Divisions (Motored)
12 Armored Divisions
2 Cavalry Divisions
93 Antiaircraft Artillery Regiments
23 Antiaircraft Artillery Battalions
Appropriate supporting units and service elements.
Extra equipment for Training Purposes

d. Merchant Marine. The present schedule of production of new merchant vessels for the calendar year of 1942 in the continental United States is 485

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vessels of 3,466,700 gross tons (includes 391 freighters, 6 combination, 83 tankers). This program was prepared prior to December 7, 1941. The Maritime Commission has initiated a program that has as its objective the construction of passenger and cargo vessels in sufficient number and types to move and maintain the material and/or forces created by the U. S. Victory Program.

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VICTORY REQUIREMENTS.

Draft Report by the American-British Joint Planning Committee.

History.

1. In September, 1941, the Planning Committee of the London Conference on Victory Requirements rendered a report*. This report was based upon the British Chiefs of Staff's view of future strategy and it contained an estimate of the ideal forces of all arms which the British considered necessary to ensure the fulfilment of their tasks in those areas of the world which were allocated to British strategic direction in ABC.1.

By deducting from this total the large forces which the British Empire expected to raise in the future, a list of estimated British deficiencies was obtained.

2. The London Conference Planning Committee further recommended that the U.S.A. should similarly estimate the American requirements and that the future needs of allied nations such as Russia and China should also be gauged. The total sum thus arrived at would then represent the total Victory Requirements of the Democratic Powers for the implementation of the agreed strategy. This Grand Total would be a guide for the planning of expanded production.

Present Position.

3. During the present Washington conversations, the Joint American-British strategy for the future conduct of the war has been agreed by the Joint Chiefs of Staff.

The examination of the target programmes for all U.S. arms on a similar basis as was done for the British in London is not yet complete. In the short time available therefore, we are only able to set out the broad implications of the requirements of naval, land and air forces. (See Annex I.) A list of the items most urgently required in a general order of priority, is given in Annex II.

* BH (41) 14.

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Recommendation.

4. The Joint American-British Planning Committee would therefore recommend that the Joint U.S.-British Chiefs of Staff should take the present opportunity of noting the position and of authorizing detailed discussions of joint requirements to proceed on the lines indicated below.

5. The Annex describes the work now being done to define an agreed A-B target in sea, land and air armaments. This target must in due course, be translated into a production programme and it is essential that the phasing of this programme should be planned to harmonise with agreed grand strategy.

6. It is not practicable to lay down absolute priorities; these would secure the completion of one part of this programme to the exclusion of all others. Allocations of capacity must, however, be such as to secure the development in proper sequence of the succession of operations contemplated in our grand strategy. We must therefore provide in the early stages for the provision of the requirements of security, especially that of sea communications, and the provision of the necessary shipping. We must also provide at an early stage in the programme, for the provision of the land, sea and air forces and war material necessary to close the ring round Germany and to maintain our defensive position in the Far East. It must also be our aim to achieve the Heavy Bomber programme in time to permit of the effective employment of the full weight of land and sea forces in the final stages.

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ANNEX I.

PART I - THE BROAD IMPLICATIONS OF NAVAL REQUIREMENTS

1. To implement the agreed essential features of our grand strategy we require:-

(a) Naval forces to maintain the security of the main areas and the communications between them.

(b) Naval forces to undertake the offensive.

(c) Mercantile tonnage to carry essential trade and to move and supply our military forces.

2. The joint production of merchant vessels, in addition to making good the losses which we suffer, must aim at providing, within the required period, sufficient tonnage to permit the deployment of our increasing strength in the areas which our strategy dictates.

3. The strength of our fleets and squadrons of heavier ships must be based in the first instance on the forces required to dominate the areas in which the enemy can operate similar forces, and secondly on an estimation of the part which heavy forces (including Aircraft Carriers) can usefully play in combined offensive operations.

4. The requirements of light forces for trade protection should be founded on an estimateion of the scale of attack which the enemy can bring to bear on all our essential sea communications.

5. These general considerations have already guided the building effort of Great Britian and the United States into programmes which will provide much of the strength required. The balance of forces, however, as

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between the British and United States Navies will change and the adjustment of areas of responsibility and the transfer of squadrons or ships between the two Powers will from time to time be necessary.

6. In order to ensure that British crews can be provided and trained to man ships built in the United States, which may at a later date be transferred to the British, it will be very important to decide upon a detailed programme of such transfers at an early date.

7. The important items in which we foresee that our present programmes will fall short of our needs are Landing Craft, Auxiliary Aircraft Carriers and Convoy Escorts.

PART II - LAND FORCES

8. The Victory Requirements for land forces are difficult to estimate for the following reasons:-

(i) No firm figures can be given for the requirements of Russia. They depend on the extent to which Russia's industrial production is reduced by the course of operations, and her supply lines are interrupted or developed.

(ii) The requirements of China may be large, especially in the small arms group. At present supplies can only reach her through the Burma Road; but this channel may be expanded and others developed.

(iii) It is quite possible that other nations, besides potential allies like Turkey and Portugal, may be brought into the war and these will certainly need armaments from U.S. and British sources. There is no great industrial nation which is not at present engaged in the conflict.

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(iv) The possibility of invading the Continent of Europe has only been examined in detail by the British General Staff in so far as the North-West of Europe is affected. There are other possible points of entry, i.e. Spain, Italy and The Balkans.

(v) There will certainly be heavy demands for armies of occupation quite apart from the requirements of patriot forces raised from the liberated peoples. The condition of Europe after the collapse of Germany is likely to be one of complete chaos.

9. The British figures have already been tabled during the discussions in London in September of 1941. As a target of actual requirements in formations to be completed in 1942, the U.S. figures have been calculated at:-

10. It seems essential, however, to aim at a high figure for capital equipment in view of the unforeseeable commitments which may arise in the future. Production capacity thus created will take care of maintenance requirements.

11. As a general principle, it appears desirable to work on a high proportion of armoured forces, since these pay a bigger dividend than infantry for the same amount of transportation - and shipping will be one of the principal limiting factors in the employment of U.S. and British land forces overseas.

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12. While equipment which is produced over and above the actual requirement of manpower serving can be stored and thus be available for a large United States Army or for issue to forces of other nations as conditions may dictate, the total amount of American manpower which will have to be called up must necessarily depend upon circumstances at the time.

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PART III - AIR FORCES

13. The target programme for the United States Army Air Forces which is at present under consideration is a first line operational strength of 21,000 aircraft excluding operational and other training units and reserves. Calculated on the same basis the British target programme is 11,500 aircraft. The combined Victory programme for United States and British Air Forces therefore provides a first line operational strength of 33,000 aircraft.

14. The British and American programmes have been examined in broad outline with a view to their co-ordination. In general it has been found that the total force envisaged will meet the requirements of our joint major strategy. A diagram is attached at Annex which illustrates a possible strategic distribution for these forces and it would seem that while distribution must be subject to changes to accord with the fluctuations in the strategic situation, there is in general no duplication of effort.

15. In considering the forces required account has been taken for the need to develop an ever-increasing air bombardment of Germany as the principal offensive method of wearing down Germany's resistance preparatory to the development of land offensives on the Continent. Account has also been taken of the essential need to obtain air superiority in every theatre and also to prepare for the development of an air offensive against Japan.

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VICTORY PROGRAM January 2, 1942.

1. The strategic objective of the Associated Powers is the defeat of Germany and her Allies by offensive operations. As a first step in U. S. preparation toward achievement of this task, the U. S. War and Navy Departments adopted the following program:

a Air Forces. The present schedule of aircraft production of all types in the United States for 1942 is approximately 46,000 aircraft, of which 27,000 are combat type. The goal for 1942 production is approximately 50,000 aircraft, of which 30,000 would be of combat type. To date only 22,000 combat planes of this production during the various months of 1942 have been allocated by the Joint Aircraft Committee to the forces of the Associated Powers. This allocation will result by the end of that year in approximately 47% of the U. S. combat aircraft production becoming available to other than U. S. forces with 35% to the U. S. Army Air Forces and 18% to the U. S. Naval Air Forces. For the various months of 1942, this production must be allocated to the Associated Powers in accordance with the joint strategic plans. This allocation of production will provide the combat equipment of the following U. S. forces by the end of 1942:

(1) Army Air Forces. (Approximately 998,000 men)
115 Groups (Approximately 7,600 combat planes) (Does not include attrition and reserves)

Heavy Bomber	34 Groups
Medium Bomber	12 "
Light Bomber	10 "
Pursuit Interceptor	25 "
Pursuit Fighter	6 "
Photo & Obsn	16 "
Transport	12 "

(2) Naval Aircraft, ship or tender-based
(Includes Marine Corps planes) (Does not include attrition and reserves)

587 Fighters
499 Scout Bombers
210 Torpedo and Torpedo Bombers
387 Scout Observation
131 Miscellaneous and Utility
72 Four-engine Patrol Planes
552 Two-engine Patrol Planes
288 One-engine Inshore Patrol Planes
192 Misc Transport-utility Types
84 Training Patrol Planes
3,002 Total Operating U. S. Naval Aircraft

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b. Naval Forces. It is expected that the 1942 production will result in the following status of the U. S. Navy:

(1) Naval Personnel. (Approximately 700,000 men)

(2) Coast Guard, designated vessels and approximately 75,000 men.

(3) Marine Corps. Approximately 150,000 men.

2 Marine Divisions
1 Separate Regiment (4th Marines)
26 Separate Battalions
15 Barrage Balloon Squadrons
Marine Corps Aircraft (listed with 1 a (2) above).

(4) Combatant Vessels.

20 Battleships (BB)
7 Aircraft carriers (CV)
18 Heavy Cruisers (CA)
27 Light Cruisers (CL)
247 Destroyers (DD)
138 Submarines (SS)
16 Escort Carriers (AVG)

(5) Large Naval Auxiliaries - - - - 326

(6) Naval Coastal Frontier Forces - 679

(7) Naval District Utility Craft - 701

(8) Expansion of Naval Shore Establishments, dry-docks, ship-building facilities, etc., to meet present and future requirements.

Present production schedules now include numerous naval items to be produced in the U. S. for delivery to the Associated Powers. The allocation of this production will be made in accordance with joint strategic plans.

c. Land Forces. Present production schedules for equipment of land forces to be produced in the United States for the Associated Powers in 1942 is inadequate to meet predicted requirements. These requirements are based on organization of the U. S. forces shown below and stated requirements of the other Associated Powers. The allocation of this production during the various months of 1942 to the Associated Powers must be made in accordance with the joint strategic plans and the current availability of supplies. While it is understood that there will be inadequate equipment for these forces, the U. S. has as an

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objective the organization by the end of 1942 of the following land forces or their equivalent:

Land Forces. (Approximately 3,000,000 men)

39 Infantry Divisions (Foot)
6 Infantry Divisions (Motored)
12 Armored Divisions
2 Cavalry Divisions
93 Antiaircraft Artillery Regiments
23 Antiaircraft Artillery Battalions
Appropriate supporting units and service elements.
Extra equipment for Training Purposes.

d. Merchant Marine. The present schedule of production of new merchant vessels for the calendar year of 1942 in the continental United States is 485 vessels of 3,466,700 gross tons (includes 391 freighters, 6 combination, 83 tankers). This program was prepared prior to December 7, 1941. The Maritime Commission has initiated a program that has as its objective the construction of passenger and cargo vessels in sufficient number and types to move and maintain the material and/or forces created by the U. S. Victory Program.

2. The U. S. Chiefs of Staff agree that the objective for 1943 and 1944 should be to exploit the production capacity of the United States in order to fullfil increased requirements in sea, land and air forces to the limit of that capacity.

3. The U. S. Chiefs of Staff propose:

That the requirements as listed herein be met as far as possible from production in the calendar year 1942.

That a determined effort be made to expedite production of items now authorized under Defense Aid appropriations and to increase production to meet additional requirements which may be agreed upon.

That the U. S. Victory Program shall be considered a general guide for long-range planning, by the United States subject to decision by the President, as to the size of the various categories of the U. S. armed forces.

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VICTORY PROGRAM

-- Language.

1. The accomplishment of the grand strategy essential to successful prosecution of the war is dependent upon availability of equipment and supplies in proper sequence and at times required. The strategy on which the Victory Program was predicated resolves itself into two broad phases:

a. The air offensive against the Axis Powers supported by ground and naval forces.

b. The invasion of Europe by ground forces supported by air and naval forces.

Coincident with the above phases, a strategic defense in the Far East is to be conducted, with a view to offensive operations against Japan when conditions dictate.

2. The acceptance of this strategy makes it mandatory that priorities for munitions be established (involving allocation of production facilities and materials) for our armed forces that are in direct correlation with the phases in par. 1 above. The specific war materials necessary to the operation of the armed forces--sea, land, and air--in the amount and proportions and at the times demanded must be predicated upon the conception of the part played by each of the armed forces in the intermediate and final phases of operations.

3. It follows then that balanced forces should be created and equipped in proper proportion and in logical relative sequence to fulfill the intermediate phase and the final phase.

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4. Therefore, the national economy must be so coordinated that production meets the requirements of the Grand strategy, rather than the reverse. The extent of operations required in pursuance of strategy should not be dependent solely upon the availability of war materials which have been produced to meet the independent and uncoordinated demands of the navies, armies, and air forces.

5. The broad conception upon which the fulfillment of the Victory Program should be based: The victory against the Axis Powers rests upon:

a. Air power in adequate force being properly applied in the intermediate operating phase for the purpose of paving the way for the final air, land, and sea offensive. Successful application of air power requires support by:

(1) Land operations necessary to secure those areas from which air forces may operate,

(2) Sea operations (surface and air) necessary to secure the sea lines of communication,

(3) Adequate cargo aircraft to maintain vital air lines of communication. (The dependence upon air transport to insure effective air operations is of increasingly greater importance.)

b. Adequate merchant marine for transporting supplies to maintain the status quo of the Associated Powers and to reinforce the armed forces of the Associated Powers in their areas of operations; to move air and supporting forces to contemplated future operating areas; and finally to move additional land and air forces to those areas from which the final offensive is launched.

c. The final offensive launched by the combined armed forces of the Associated Powers at that time when air superiority has been or is being reached.

6. The coordinating principles underlying the progress of the Victory Program and based upon the above concept may be stated as follows:

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c. The essential air forces, as contemplated in the Victory Program, must be equipped at the earliest practicable date. This requirement is inclusive of cargo aircraft in adequate numbers, doctrines in excess of those included in the Victory Program, to move and maintain equipment, supplies, and personnel to operating areas which cannot be otherwise maintained as operating bases against Axis powers.

d. The navies must be provided initially with the minimum forces required to dominate the vital sea lines of communication against which the enemy can operate with similar forces and finally with those forces deemed essential to the support of the final offensive.

e. The armies must be equipped initially to secure and defend the bases necessary for air operations against the Axis nations and subsequently to provide those forces estimated as essential in the final offensive.

f. In summation, the allocation of production must be predicated upon creation of the air forces set forth in the Victory Program in the shortest practicable time, and the balancing of all other requirements in relation thereto, in consonance with the conception and principles outlined heretofore. (See Tab A for diagrammatic outline of principles.)

II. Recommendations.

1. That this paper be accepted as the basis for the coordination of the Victory Program.

2. That a board consisting of Army, Navy, and Air Force representatives be appointed to work out, in conjunction with production officials, the priorities in production and allocation of facilities and materials in consonance with the principles outlined in this paper.

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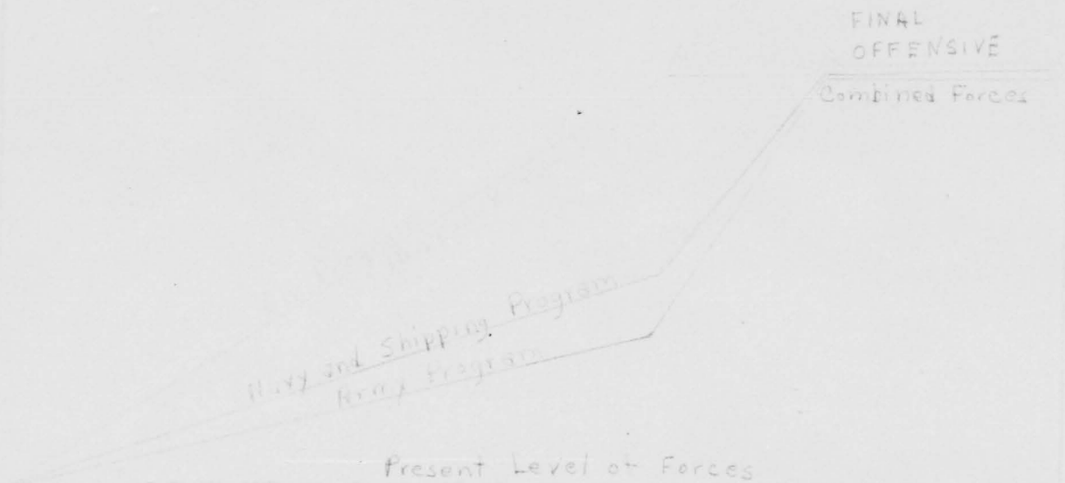
Tab A

Chart Outlining Basic Principles

for

Coordination of Victory Program

TAB A



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VICTORY PROGRAM

I. Discussion.

1. The accomplishment of the grand strategy essential to successful prosecution of the War is dependent upon availability of equipment and supplies in proper sequence and at times required. The strategy on which the Victory Program was predicated resolves itself into two broad phases:

a. The air offensive against the Axis Powers supported by ground and naval forces.

b. The invasion of Europe by ground forces supported by air and naval forces.

2. The acceptance of this strategy makes it mandatory that priorities for munitions be established for our armed forces that are in direct correlation with the phases in par. 1 above. The specific war materials necessary to the operation of the armed forces -- sea, land,

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and air -- in the amount and proportions and at the times demanded must be predicated upon the conception of the part played by each of the armed forces in the intermediate and final phases of operations.

3. It follows then that balanced forces should be created and equipped in proper proportion and in logical relative sequence to fulfill the intermediate phase and the final phase.

4. Therefore, the national industry must be so coordinated that production meets the requirements of the grand strategy, rather than the reverse. The extent of the operations required in pursuance of strategy should not be dependent solely upon the availability of war

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materials which have been produced to meet the independent and uncoordinated demands of the navies, armies, and air forces.

5. The following is advanced as the broad conception upon which the fulfillment of the Victory Program should be based. The victory against the Axis powers rests upon:

a. Air power in adequate force being properly applied in the intermediate operating phase for the purpose of paving the way for the final air, land, and sea offensive. Successful application of air power requires support by:

(1) Land operations necessary to secure those areas from which air forces may operate,

(2) Sea operations (surface and air) necessary to secure the sea lines of communication.

(3) Adequate cargo aircraft to maintain vital air lines of communication. The dependence upon air transport to insure effective air operations is of increasingly greater importance.

b. Adequate merchant marine for transporting supplies to maintain the status quo of the Associated Powers and to reinforce the armed forces of the Associated Powers in their areas of operations; to move air and supporting forces to contemplated future operating areas; and finally to move the additional land and air forces to those areas from

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which the final offensive is launched.

c. The final offensive launched by the combined armed forces of the Associated Powers at that time when air superiority has been or is being reached.

6. The coordinating principles underlying the progress of the Victory Program and based upon the above concept may be stated as follows:

a. The essential air forces as contemplated in the Victory Program must be equipped at the earliest practicable date. This requirement is inclusive of cargo aircraft in adequate numbers, doubtless in excess of those included in the Victory Program, to move and maintain equipment, supplies, and personnel to operating areas which cannot be otherwise employed as operating bases against Axis powers.

b. The navies must be provided initially with the minimum forces required to dominate the vital sea lines of communication against which the enemy can operate with similar forces and finally with those forces deemed essential to the support of the final offensive.

c. The armies must be equipped initially to secure and defend the bases essential for air operations against the Axis nations and finally to provide those forces estimated as essential in the final offensive.

d. In summation, the allocation of production must be predicated upon creation of the air forces set forth in the Victory Program

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in the shortest practicable time, and the balancing of all other requirements in relation thereto:

7. The above proposed coordinating principles may be summarized by the following diagram:

Chart Outlining Basic Principles

for

Coordination of Victory Program

FINAL OFFENSIVE
Combined Forces

Present Level of Forces

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II. Recommendations.

1. That this paper be accepted as the basis for the coordination of the Victory Program.

2. That a board consisting of Army, Navy, and Air Force representatives be appointed to work out, in conjunction with production officials, the priorities in production in consonance with the principles outlined in this paper.

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WAR DEPARTMENT
HEADQUARTERS OF THE ARMY AIR FORCES
WASHINGTON

Discussion of the American Victory Program

(Prepared by Air War Plans Division, the Air Staff)

1. HISTORY.

a. The studies, resulting in the so-called Victory Program, were undertaken at the instance of a request by the President in a letter of July 9, 1941, to the Secretary of War requesting the exploration of over-all production requirements required to defeat our potential enemies.

b. As a result thereof, the Navy and Army prepared detailed requirements of those forces and that equipment deemed essential.

c. It was understood that the results of these requirements, incorporated in a document titled "Army and Navy Estimate of United States Over-all Production Requirements, September 11, 1941" and submitted by the Joint Board, would be treated in the following general manner, but not necessarily in the following order:

(1) The Office of Production Managements and related procurement agencies were to determine the ability of industry

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to meet the requirements, both in quantity and time.

(2) Representatives of the Army (including the Army Air Forces), the Navy and procurement agencies were to confer and reconcile differences with regard to conflicting requirements.

(3) As a basis for such reconciliation, the Army (including the Army Air Forces) and Navy representatives were to prepare recommendations as to requirements in military equipment based upon the order and time when such equipment was to be employed.

(4) The requirements of both the American and British Armed Forces were to be considered by joint British-American Conferences and a basis reached for allocation of production as between the United States, the British, and other nations opposing the Axis and all requirements finally reconciled on that basis.

d. So far as is known by the Headquarters, Army Air Forces, the problem has not to date been treated in the manner outlined, other than in a preliminary way (such as represented by London Conference of 17 September 1941, entitled BH 10).

2. JOINT AMERICAN-BRITISH STRATEGY AS BASIS FOR REQUIREMENTS.

a. The joint American-British strategy for the conduct of

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the war has been agreed upon during the present Washington conferences. This provides a broad directive which may be employed as a basis for production requirements of the Victory Program.

b. Of the utmost importance, however, are specific directives, agreed upon jointly by the United States and Great Britain, which will provide a definite guide for a joint American-British Planning Committee designated to prepare in detail the requirements of the Allied armed forces, both in quantity and in time.

3. THE CREATION OF BALANCED FORCES.

a. Fulfillment of strategical plans must contemplate the creation of balanced forces. Such balanced forces must be created upon a time basis dependent upon the ability to employ such forces with regard to time.

b. Furthermore, the relative importance of the several services or arms with regard to their employment as to time must be examined carefully. Conclusions drawn therefrom must be the guide in producing the war materials required for each service.

c. Unfortunately, the industrial capacity of the Allied nations will not permit concurrent production of the ultimate material required by the Armies, Navies, and Air Forces. If this were not so, there would

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be no problem. Any attempt to produce simultaneously the ultimate forces required is likely to result in having only a part of any specific force available when it is needed.

d. Definite conclusions must therefore be drawn as to those time periods when the forces of the Armies, the Navies, and the Air Forces play a dominant part in fulfilling the grand strategy. Those weapons of the specific services must be given priority, and the balanced force created by producing concurrently the arms and materials required by the other services in fulfillment of their essential supporting action.

4. ALLOCATION OF PRIORITIES AS THE KEYNOTE OF THE VICTORY PROGRAM.

a. The balanced forces required as to time periods may only be created by correct and accurate allocation of priorities for production and the related allocation of priorities in personnel.

b. For example, it is unwise to allocate to the Air Force a high priority in airplanes, and then to allocate to another service, at the expense of the Air Force, a high priority in guns, cannon, engines, and ammunition essential to transposing the airplanes into fighting machines.

c. Priorities must be established upon the creation of the balanced forces as to time periods and concessions must be made to the

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dominant force. The demands of each service may only be considered in relation to the requirements of all other services essential to creating the balancel force.

5. RECOMMENDATION.

a. A permanent Joint Allied Planning Committee should be established for the purpose of constantly examining the progress of the Victory Program and proposing recommendations as to priorities and adjustment thereof. The committee should be composed of Naval, Army, and Air Force representatives of the Allied nations.

b. The committee should be provided with a directive which breaks into time periods contemplated phases of operation predicated upon the grand strategy. The dominant force should be specified for each of the phases of operations. Upon this basis the Committee determines the balanced forces required, the priorities essential to their creation, and prepares recommendations in consonance therewith.

c. The Committee should function as an American-British Military Priorities Board and be given the authority to approve priorities upon the approval (and modification when made) of their recommendations.

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Basis for Coordinating Production.

1. Existing committments must be fulfilled.

   a. Adequate shipping must be provided for:
      Maintenance of U. K.
      Maintenance of U. S.
      Maintenance of Associated Forces in Near East, Middle East, and Pacific including planned reinforcements and replacements. Movement of essential raw materials for development of the Victory Program.

   b. Adequate ground forces and their equipment must be provided for:
      Security of U. K.
      Security of U. S. and Western Hemisphere, and Pacific Islands. Strategic defense of ABDU. Training for development of Victory Program.

   c. Adequate naval forces must be provided to convoy and protect essential shipping in a.

2. The combined air program must be fulfilled and sustained at the earliest possible date after 1 above has been satisfied.

3. The land and sea forces must be provided in proper proportion to launch an overseas offensive against Germany - 6 MONTHS AFTER THE ALL OUT AIR OFFENSIVE LISTED ABOVE HAS BEEN LAUNCHED.

   Adequate shipping for this force will be required at that time.

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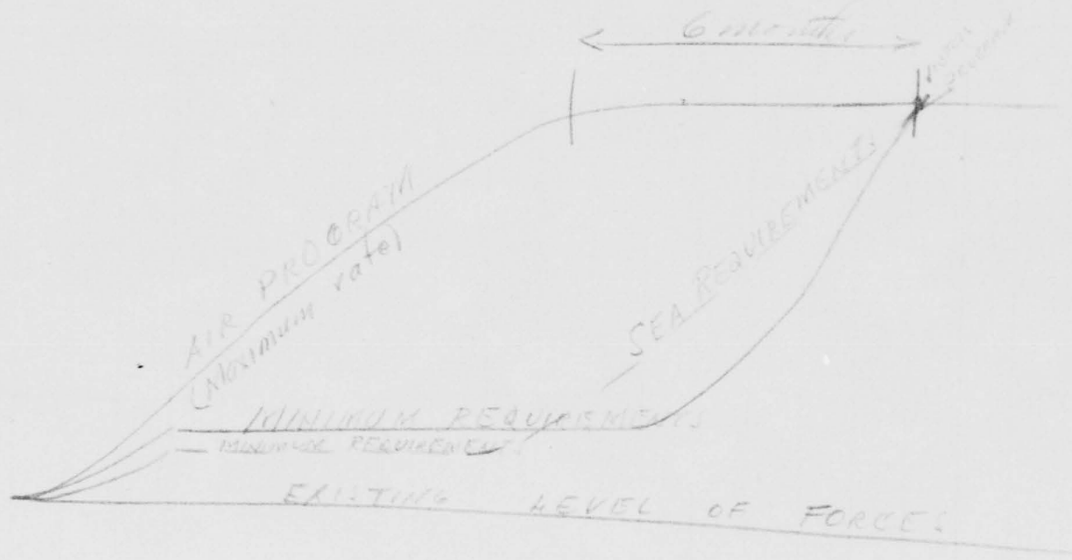

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VICTORY PROGRAM

1. Discussion.

1. The accomplishment of the grand strategy essential to successful prosecution of the War is dependent upon availability of equipment and supplies in proper sequence and at times required. The strategy on which the Victory Program was predicated resolves itself into two broad phases:

a. The air offensive against the Axis Powers supported by ground and naval forces.

b. The invasion of Europe by ground forces supported by air and naval forces.

Coincident with the above phases, a strategic defense in the Far East is to be conducted, with a view to offensive operations against Japan when conditions dictate.

2. The acceptance of this strategy makes it mandatory that priorities for munitions be established (involving allocation of production facilities and materials) for our armed forces that are in direct correlation with the phases in par. 1 above. The specific war materials necessary to the operation of the armed forces--sea, land, and air--in the amount and proportions and at the times demanded must be predicated upon the conception of the part played by each of the armed forces in the intermediate and final phases of operations.

3. It follows then that balanced forces should be created and equipped in proper proportion and in logical relative sequence to fulfill [illegible] phase and the final phase.

HEADQUARTERS ARMY AIR FORCES - COORDINATION

Chief of Staff	Secy Air Staff	A.A.G.	A-1	A-2	A-3	A-4	A- WPD	A. Insp.	Budget	Statistics	

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4. Therefore, the national industry must be so coordinated that production meets the requirements of the grand strategy, rather than the reverse. The extent of operations required in pursuance of strategy should not be dependent solely upon the availibility of war materials which have been produced to meet the independent and uncoordinated demands of the navies, armies, and air forces.

5. The broad conception upon which the fulfillment of the Victory Program should be based: The victory against the Axis Powers rests upon:

a. Air power in adequate force being properly applied in the intermediate operating phase for the purpose of paving the way for the final air, land, and sea offensive. Successful application of air power requires support by:

(1) Land operations necessary to secure those areas from which air forces may operate,

(2) Sea operations (surface and air) necessary to secure the sea lines of communication,

(3) Adequate cargo aircraft to maintain vital air lines of communication. (The dependence upon air transport to insure effective air operations is of increasingly greater importance.)

b. Adequate merchant marine for transporting supplies to maintain the status quo of the Associated Powers and to reinforce the armed forces of the Associated Powers in their areas of operations; to move air and supporting forces to contemplated future operating areas; and finally to move additional land and air forces to those areas from which the final offensive is launched.

c. The final offensive launched by the combined armed forces of the Associated Powers at that time when air superiority has been or is being reached.

6. The coordinating principles underlying the progress of the Victory Program and based upon the above concept may be stated as follows:

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a. The essential air forces, as contemplated in the Victory Program, must be equipped at the earliest practicable date. This requirement is inclusive of cargo aircraft in adequate numbers, doubtless in excess of those included in the Victory Program, to move and maintain equipment, supplies, and personnel to operating areas which cannot be otherwise maintained as operating bases against Axis powers.

b. The navies must be provided initially with the minimum forces required to dominate the vital sea lines of communication against which the enemy can operate with similar forces and finally with those forces deemed essential to the support of the final offensive.

c. The armies must be equipped initially to secure and defend the bases necessary for air operations against the Axis nations and subsequently to provide those forces estimated as essential in the final offensive.

d. In summation, the allocation of production must be predicated upon creation of the air forces set forth in the Victory Program in the shortest practicable time, and the balancing of all other requirements in relation thereto, in consonance with the conception and principles outlined heretofore. (See Tab A for diagrammatic outline of principles.)

II. Recommendations.

1. That this paper be accepted as the basis for the coordination of the Victory Program.

2. That a board consisting of Army, Navy, and Air Force representatives be appointed to work out, in conjunction with production officials, the priorities in production and allocation of facilities and materials in consonance with the principles outlined in this paper.

HEADQUARTERS ARMY AIR FORCES - COORDINATION

Chief of Staff	Dep Air Staff	A.A.G.	A-1	A-2	A-3	A-4	A- WPD	A. Insp.	Budget	Statistics	

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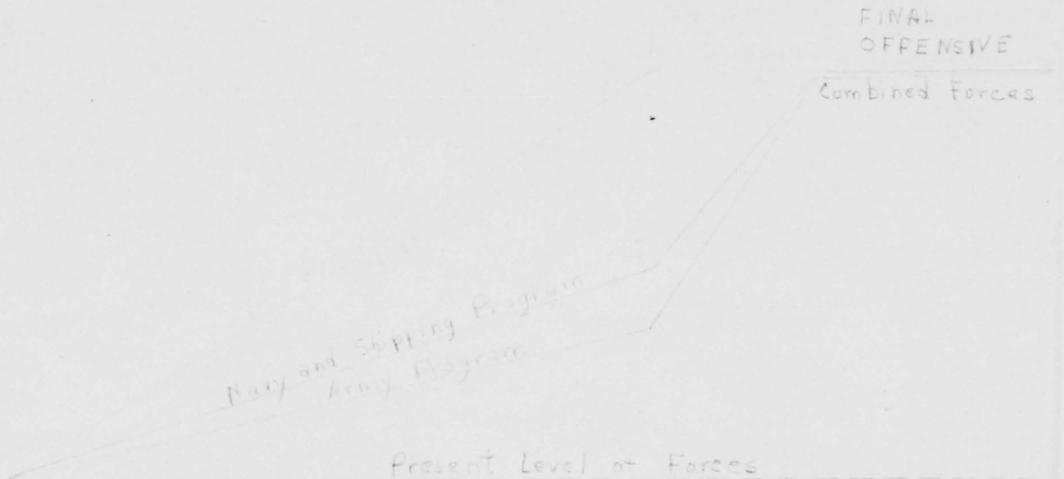
Tab A

TAB A

Chart Outlining Basic Principles

for

Coordination of Victory Program



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COLLABORATION
for A-B PLANNING

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Final Draft

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Subject: Collaboration for A-B Planning.

1. The Joint Planning Committee considered the following directive:

"A consideration of any steps that should be taken in the light of experience up to date to implement, improve, or extend the system of collaboration between the United States - British Staffs as laid down in ABC-1; the need for allocating joint resources on a strategic basis to be taken into account."

2. After examination of the machinery for collaboration provided in ABC-1 it was concluded that:

a. Decisions on plans to be put in effect would be taken by the heads of the Government and their Chiefs of Staffs at periodic meetings, or otherwise as required.

b. That plans to implement approved operations would be prepared by the power selected to execute the operations. In the development of plans for such operations, or when matters of common interest are under consideration, the heads of military missions set up in ABC-1 would be members of the Chiefs of Staffs Committee or the Joint Board respectively, and appropriate officers of each mission would correspondingly be members of the Joint Planning Committee in each country.

c. When joint A-B operations are to be undertaken the commander should be appointed by agreement. The Commander would be provided with a joint A-B staff for the elaboration of the basic plan for the operation.

3. In addition to the above, it is considered necessary that a Joint A-B Strategic Board, composed of one officer of each British and U.S. Service, representing the respective Chiefs of Staffs, be established. This strategic board should be located in Washington and should be charged with:

a. Continuous study of joint A-B strategy and frequent report and recommendation to respective Chiefs of Staffs.

b. Prepare agenda for periodic joint meetings of Chiefs of Staffs.

c. Receive and make proposals for future operations; study means required for them, their feasibility, power by which they should be undertaken, and in the case of joint operations, recommend the forces and means to be provided by each power.

d. Make appropriate recommendations to Chiefs of Staffs in regard to material needs, priorities and allocations on broad strategic grounds.

4. The Joint A-B Strategic Board, in discharge of its responsibilities, should be empowered to obtain all necessary information and advice from appropriate agencies and departments of the Governments.

5. The Joint A-B Strategic Board further offers a means for coordinating the joint operations and strategy of all Allied and Associated Powers.

Washington, D. C.
December 30, 1941.

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Initial Draft

A-B

Subject: Collaboration for Planning.

1. The Joint Planning Committee considered the following directive:

"A consideration of any steps that should be taken in the light of experience up to date to implement, improve, or extend the system of collaboration between the United States - British Staffs as laid down in ABC-1; the need for allocating joint resources on a strategic basis to be taken into account."

2. After examination of the machinery for collaboration provided in ABC-1 it was concluded that:

a. Decisions on plans to be put in effect would be taken by the heads of the Government and their Chiefs of Staffs at periodic meetings, or otherwise as required.

b. That plans to implement approved operations would be prepared by the power selected to execute the operations. In the development of plans for such operations, or when matters of common interest are under consideration, the heads of military missions set up in ABC-1 would be members of the Chiefs of Staffs Committee or Joint Board, ~~respectively in each country~~, and appropriate officers of each mission would correspondingly be members of Joint Planning Committee in each country.

c. When joint operations are to be undertaken the commander to be appointed by agreement. The Comnader would be provided with a joint staff for the elaboration of the basic plan for the ~~joint~~ operation.

3. In addition to the above, it is considered necessary that a joint strategic board, composed of a ~~suitable~~ officer of each British and U.S. Service, representing the respective Chiefs of Staffs, be established. This strategic board should be located in Washington and should be charged with:

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d. Make appropriate recommendations to Chiefs of Staffs in regard to material needs, priorities and allocations on broad strategic grounds.

4. The Joint Strategic Board, in discharge of its responsibilities, should be empowered to obtain all necessary information and advice from appropriate agencies and departments of the Governments.

5. The Joint Strategic Board further offers a means for coordinating the joint operations and strategy of all Allied Powers.

Washington, D. C.
December 30, 1941.

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CONFERENCE ON

U.S. - BRITISH PRODUCTION

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B. H. (41) 10.

17th September, 1941

Note by the Secretary.

The attached report has been prepared by a Sub-Committee consisting of the following: -

American Representatives.

Captain Frank P. Thomas, U.S.N.

Captain Wentworth, U.S.N.

Colonel Bundy, U.S. Army.

British Representatives.

Captain Bellars)
Brigadier Dykes) Directors of Plans.
Air Commodore Dickson)

2. It is submitted to the Sub-Committee which was appointed by the Conference to study the question of victory requirements. Unless the Sub-Committee wishes to meet to discuss this report, the work will proceed as proposed in paragraph 9.

(Signed) A.T. CORNWALL-JONES

Great George Street, S.W.1

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B.H. (41) 10.

COPY NO. 69

17th September, 1941.

CONFERENCE ON BRITISH-UNITED STATES PRODUCTION.

VICTORY REQUIREMENTS.

Interim report by the Planning Sub-Committee.

As we understand it, the ultimate object is to produce a statement of the overall production requirements for the defeat of enemies and potential enemies. It has been agreed that these requirements should be based on the strategic needs of the situation.

2. As a first step we have compared the British and American strategic concepts.

3. The strategic defense policies of the United States and the British Commonwealth have been clearly defined in paragraph 11 of A.B.C.1 and agreed between the American and British Chiefs of Staff. They remain the foundation of our joint strategy.

4. We find the American and British conceptions of future offensive strategy also to be very much the same. We are agreed for instance, that the complementary methods by which Germany can be prepared for ultimate defeat are as follows: -

(a) The air offensive.

(b) The blockade.

(c) Subversive activities.

We are also agreed that it may for her ultimate defeat eventually be essential to land forces on the Continent and penetrate into Germany. We do not visualise the employment of vast armies of infantry as in 1918. The forces which will be required will be mainly armoured divisions with the most modern equipment. It will not be possible to land even these until the fighting efficiency of the German armed forces has been sufficiently decreased.

5. The impact of the Russian war has not changed our fundamental concept. The longer the Russians can be maintained in the field, however, the quicker the process of German disintegration. We must therefore consider what is necessary to sustain the Russian front.

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6. We must also take into consideration the needs of Turkey, China and other friendly powers, and we must count on the possibility of Japanese hostility.

7. It is against the background of these defensive and offensive policies that our victory requirements must be planned. It is quite clear that the security of sea communications and the provision of the shipping required for the maintenance of our respective War efforts and for the transportation of forces and equipment to the active theatres of war will be an overriding factor. Similarly the production of overwhelming air forces will be needed, since without this, the preparation of Germany for the final blow cannot be achieved.

8. To achieve the required statement of overall production requirements for victory, it seems clear to us that the following steps must be taken : -

(a) The estimates of Joint British and United States requirements which have been prepared must be adjusted and correlated in order to eliminate duplication.

(b) An estimate of what is required to maintain Russian resistance must be made, based on information received in Moscow.

(c) The above estimates must be pooled and compared with the existing joint British and United States productions. It will then be possible to obtain a picture of what further production is required.

(d) It will then be for the authorities charged with production and supply to relate these strategic requirements to the realities of production. If they seem impracticable adjustment on a strategical basis will be necessary. This process of adjustment will have to be repeated until an agreed target figure is reached.

9. We consider it will be possible to achieve (a) above in London and we are proceeding to make our recommendations for an adjustment and correlation of the American and British figures which we have at our disposal. From this study, will emerge, for the most critical items, a list based on strategical considerations alone, of the total joint American and British requirements. We do not anticipate being able to produce this list before Saturday, 20th September.

10. It seems to us that the remaining steps must be taken in Washington after the return of the Delegations from Moscow.

Great George Street, S.W.1
17th September, 1941.

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September 17, 1941.

VICTORY REQUIREMENTS COMMITTEE.

THE COMMITTEE, under the chairmanship of General Embick, met at 11;00 a.m. to discuss the procedure in tackling the problem of victory requirements.

GENERAL EMBICK invited the British Representatives to give their ideas on the problem.

BRIGADIER DYKES explained that, in response to a desire for a list of overall requirements for victory, the British Staffs had prepared a tentative estimate of the forces which they thought would be necessary in British areas of responsibility. This first approximation was in the nature of the first approximate plan which a prospective housebuilder might draw up for his architect. As he might draw up a plan showing what he would like, so the British Staffs had drawn up these estimates of what forces they thought, from a purely strategical point of view, should be aimed at to create in British areas of responsibility. As the housebuilder would have to refer his first plan to his architect, so it was appreciated that this first approximation would have to be discussed with the American Representatives and subsequently with Supply Departments until, by a process of elimination, it would be possible to get down to concrete facts. The figures which had been produced were based on strategical considerations alone and were put forward as a basis for discussion. They were based on the forces which it seemed would be required in the various theatres, and potential theatres of war, for which the British were responsible, and account had been taken of the likely scales of enemy attack and the general way in which the war would probably develop. At the same time an attempt had been made to relate the requirements to the probable capacity of joint production. He (Brigadier Dykes) emphasised the fact that the estimates were for the total joint forces required, irrespective of whether they were British or American.

He asked whether American Representatives had carried out a similar study, and if so on what basis it had been worked out. It seemed important that if we were to produce target figures for joint British United States production, they should be formulated on the same strategic basis.

COLONEL BUNDY said that under the President's direction a study of overall requirements for the defeat of potential enemies had been carried out by the War and Navy Departments. This study was based on a strategical conception which was much similar to that which the British Chiefs of Staff had handed to the American Chiefs of Staff at the recent conference at sea. On this basis, and having regard to the total forces which the enemy could dispose, an attempt had been made to draw up a list of the major units which would be required for victory, as a basis for production. It was appreciated that shipping would be a most serious consideration. It seemed essential

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that large forces should be brought to the scene of action, and if this were so it was clearly essential that the shipping effort would have to be on a scale far greater than hitherto contemplated.

He (Colonel Bundy) pointed out that the American Representatives could not enter into any commitments in respect of Victory requirements, but he thought it essential that they should take back with them an agreed version of the forces which were required for victory, so that they could be discussed in Washington.

ADMIRAL STANDLEY emphasised the necessity for reaching agreement on the priorities between the main items which it would be necessary to produce. This priority must be based upon an agreed strategical plan.

GENERAL SIR HASTINGS ISMAY stressed the necessity for reaching agreement on the strategical basis for long-term production plans before the departure to Moscow. It seemed likely that the Russians would press for a discussion on strategy, and it would be invaluable if the American and British Representatives could, if necessary, speak with one voice.

COLONEL BUNDY suggested that a small Sub-Committee should be appointed to study the question and report to the main Sub-Committee.

THE SUB-COMMITTEE agreed:-

(a) that a small Sub-Committee should be appointed for this purpose;

(b) that the composition of this Sub-Committee should be as follows:-

American Representatives	British Representatives
Captain Thomas, U.S. Navy.	Captain Bellars, Director of Plans, Admiralty.
Captain Wentworth, U.S. Navy.	Brigadier Dykes, Director of Plans, War Office.
Colonel Bundy, U.S. Army.	Air Commodore Dickson, Director of Plans, Air Ministry.

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W.M. (41) 2nd Meeting. COPY NO. 56

WAR CABINET.

CONFERENCE ON BRITISH-UNITED STATES PRODUCTION.

RECORD of a Meeting held at the Offices of the War Cabinet, Great George Street, S.W.1, on SATURDAY, 20TH SEPTEMBER, 1941, at 3.0 p.m.

PRESENT:

The Right Hon. C. R. Attlee, M.P., Lord Privy Seal. (In the Chair).
The Right Hon. Lord Beaverbrook, Minister of Supply.
Captain the Right Hon. H. H. Balfour, M. P.

Admiralty.

Vice Admiral Sir Tom S. V. Phillips.
Captain E.G.N. Bellars

War Office.

Major-General C. M. Macready.
Brigadier V. Dykes

Air Ministry.

Air Chief Marshal Sir Charles F. A. Portal.
Air Commodore W. F. Dickson.
Group Captain W. M. Yool.

Ministry of Supply.

Sir Walter Layton.
Mr. A.F. Dobbie-Bateman

Ministry of Aircraft Production.

Sir Archibald Rowlands.
Mr. F. W. Smith.

Office of the Minister of Defence.

Major-General Sir Hastings L. Ismay.

Mr. W. A. Harriman.
Mr. J. D. Biggars,
Mr. W. L. Batt, Office of the Production Management.

U.S. ARMY.

Lt.-General S. D. Embick.
Major-General Jas. H. Burns.
Major-General J. E. Chaney.
Brigadier-General J.F. McNarney.
Colonel W.W. Taylor.
Colonel A. J. Lyon.
Lt.- Colonel C.N. Bundy.
Lt.-Colonel C. L. Bolte.

U.S. NAVY.

Admiral W.H. Standley.
Vice Admiral R. L. Ghormley.
Captain R. S. Wentworth.
Captain F. P. Thomas.

SECRETARIAT:

Lt.-Colonel H.I.C. Jacob.
Lt.-Colonel A.T. Cornwall-Jones.

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THE CONFERENCE had before them a Report by the Planning Committee giving the results of a joint study of Overall Production Requirements for Victory. (Paper C. O. (41)14).

THE CHAIRMAN invited members of the Planning Committee to explain the basis of their Paper.

CAPTAIN BENJAMIN explained that an estimate had been made of Overall Requirements of the Royal Navy and the Fleet Air Arm. This table set out an estimate of the total British requirements based on strategical considerations, gave the figures of anticipated rate of loss and the amount of construction which could be undertaken in British yards, leading up finally to a statement of total deficiencies which would have to be made up by the United States. Figures had also been produced to show the requirements in aircraft of the Fleet Air Arm. He pointed out that the overall picture was incomplete in the absence of similar figures showing United States Navy requirements.

The problem of merchant shipping had also been considered. Estimates had been made of the total British requirements, the rate of loss had been taken into consideration and figures showing the anticipated rate of British building had been included. From these calculations a deduction had been made of the extra merchant shipping which would be required from United States resources, over and above that which was already been built in the U.S.A. to British account.

BRIGADIER DYKES explained the calculations which had been made in respect of the Army requirements. An estimate had been made of the total forces required in British Areas of strategical responsibility. All these could not be found from British resources. The requirements in the main items of equipment for those forces which could be found from British resources had been worked out and an estimate had been given as to how far these requirements could be met from British production. From this could be obtained a picture of the contribution which was required from the United States. Data giving the equivalent United States requirements was not available in London and had not been included.

AIR COMMODORE DICKSON explained the calculations in respect of Air Force requirements. An estimate had been made of the total joint Air Forces required in both British and United States areas of responsibility. From these had been drawn up figures showing the aircraft required to meet the purely British target programme and a forecast of United Kingdom production had been made. From this the number of aircraft required of United States by the British could be worked out.

BRIGADIER DYKES pointed out that it had been fully realised by the Planning Committee that when these estimates were coupled with the equivalent United States estimates and were presented to the Production Authorities they might not be possible of achievement. The figures would be immense and might be beyond the resources of the United States having regard to the time within

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which it was desired that the requirements should be met. In any event conflicts between major items in the lists would be certain to arise. Thus when they came to be examined by the Production Authorities some modification would almost certainly be necessary. The Staffs would have to scale down some of their requirements to meet the realities of production. The point which the Planning Committee wished to emphasize was that such scaling down should be determined on a strategical basis between the Joint British and United States Staffs. This procedure need not take a long time. Speed was essential as every week counted. For this reason the Planning Committee had put forward recommendations as to procedure in order to complete the full picture of the Overall Victory Requirements required by the President.

COLONEL BUNDY said that the American representatives fully appreciated the urgency of the problem. Officers would shortly be returning to Washington to recommend the immediate preparation of American figures in the light of the information obtained during the discussions in London. These would then be referred to the Office of Production Management for urgent examination. The American representatives were fully in accord with the views of the British Directors of Plans that any modifications which might prove necessary should be worked out between the British and United States Staffs on a strategical basis. This could only be done in Washington.

Some discussion then ensued on the question of priorities. The Conference referred to Paragraph 6 of the Report by the Planning Committee in which reference was made to the prime need for the production of merchant shipping, heavy bombers and tanks.

MR. HARRIMAN said that these major deficiencies were known in the United States. He asked whether the Planning Committee's study of Victory Requirements had disclosed any particular items in the American production programme to which the attention of the President might be drawn, so that he might set on foot an immediate acceleration.

ADMIRAL STANDLEY thought that it would be a great mistake to pick out from this first study by the Planning Committee any particular items with a view to their receiving an immediate priority. The Planning Committee's estimates were admittedly incomplete and required much further study, but to take a portion of the problem and place it in the fore-front would be to throw the whole programme out of balance.

LORD BEAVERBROOK agreed but added that quite apart from the programme of Victory Requirements there were certain items of equipment the production of which had confronted the British with much difficulty, and in which output had fallen short of hopes. He recommended that these should be brought to the notice of the President from that point of view.

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Such items were:-

(1) Tank and anti-tank weapons.

(2) Armour-piercing shells for field guns and A.A. guns of over 40 mm. calibre.

(3) Chemical shells.

(4) Predictors.

(5) Rifles.

MR. BATT suggested that the practical step might be proposed to the President of securing in the second half of 1942 the output now planned for the first half of 1943.

Returning to the Planning Committee Paper, SIR CHARLES PORTAL drew attention to the priorities dealt with in Annex V. He thought it would be a mistake if the Conference gained the impression from this Annex that first priority in aircraft production should be allotted to fighters. In point of fact the fighter production was much nearer to requirements than that of heavy bombers. Although no one would deny the necessity for securing the bases without which it would be impossible to continue the war, the British Chiefs of Staff were all agreed that the creation of an overwhelming Air Force was an essential preliminary to any land operations on the Continent. The air offensive must prepare the way for eventual victory and the production of heavy bombers was, therefore, a matter of the greatest urgency.

LORD BEAVERBROOK proposed, and MR. HARRIMAN seconded, that the Conference should adopt the Report by the Planning Committee.

THE CONFERENCE:-

(a) Adopted the Report by the Planning Committee, (B.P.(41)14), and recommended that the procedure proposed in paragraph 7 should be carried forward with the utmost despatch.

(b) Agreed that, as an immediate step which might be taken pending the completion of the plan for the Victory programme, the attention of the President might with advantage be drawn to the need for accelerating the production of the items listed at 'X' above.

THE CONFERENCE then exchanged compliments and adjourned.

Great George Street, S.W.1.

20th September, 1941.

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Great George Street, S.W.1.

20th September, 1941.

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WAR CABINET

CONFERENCE ON BRITISH-UNITED STATES PRODUCTION.

VICTORY REQUIREMENTS
(Paper No: B.H.(41)14 (Also circulated as Paper No. C.O.S.(41)215(o).)

C O R R I G E N D A

In the process of printing paper No.:B.H.(41)14 (also circulated as C.O.S.(41)215(O).) some of the figures in Enclosure 1 to Annex 1 have become mis-placed. It is requested that the following amendments may be made to the existing print under the columns "Desired from the United States":-

(i) Under "July 1944"

Against:	Cruisers (Light)	- insert: 3
"	Destroyers	" 20
"	Submarines	" 10
"	Escorts	" 100
"	Naval Coastal Frontier Forces	insert 60

(ii) Under "Jan. 1945"

Against:	Cruisers (Light)	- delete 3 and substitute 2;
"	Destroyers	delete 20 and substitute 5;
"	Submarines	delete 10;
"	Escorts	delete 100 and substitute 60;
"	Naval Coastal Frontier Forces	delete 60.

(iii) Under "July, 1945"

Against:	Destroyers	- delete 5;
"	Escorts	delete 60.

(iv) Under "Jan. 1946"

Against:	Cruisers (Light)	- delete 2 and substitute 1.

(v) Under "July, 1946"

Against:	Cruisers (Light)	- delete 1.

SIgned) A. T. CORNWALL-JONES.

Great Smith Street, S.W.I
23rd September, 1941

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Printed for the War Cabinet. September, 1941

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B.H. (41) 14. Copy No. 10

September 19, 1941.

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WAR CABINET.

CONFERENCE ON BRITISH-UNITED STATES PRODUCTION.

VICTORY REQUIREMENTS.

Report by the Planning Committee.

THE ultimate object is to produce a statement of the overall production requirements for the defeat of enemies and potential enemies.

2. In order to relate the problem to the strategic needs of the situation, we first compared the British and American strategic concepts. The strategic defence policies of the United States and the British Commonwealth have been clearly defined in paragraph 11 of A.B.C. 1 and agreed between the American and British Chiefs of Staff. They remain the foundation of our joint strategy. Our concepts of future offensive strategy we also found to be very much the same. We are agreed, for instance, that the complementary methods by which Germany can be prepared for ultimate defeat are:-

(a) The Air offensive.
(b) The blockade.
(c) Subversive activities.

We are also agreed that it may, for her ultimate defeat, eventually be essential to land forces on the Continent and penetrate into Germany. We do not visualise the employment of vast armies of infantry as in 1918. The forces which will be required will be mainly armoured divisions with the most modern equipment. It will not be possible to land even these until the fighting efficiency of the German armed forces has been sufficiently decreased.

3. The impact of the Russian war does not change this fundamental concept. The longer the Russians can be maintained in field, however, the quicker will be the process of German disintegration. We must, therefore, consider what is necessary to sustain the Russian front.

4. We must also take into consideration the needs of Turkey, China and other friendly Powers, and we must count on the possibility of Japanese hostility.

5. It is against the background of these defensive and offensive policies that we have produced the attached preliminary estimates of victory requirements. These will be found set out in Annexes as follows:—

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NAVAL REQUIREMENTS.

(a) In Annex I will be found a statement of the overall requirements of the Royal Navy and the Fleet Air Arm. The figures include an estimate of what the British require in the shape of Naval vessels from the United States. No mention is made of the United States own requirements.

ARMY REQUIREMENTS.

(b) In Annex II will be seen the British conception of the land forces required in areas of British strategic responsibility. All these cannot be found from British resources. The equipment requirements of those which can be found from British resources are accordingly set out in the enclosures to this Annex, and an estimate is given which shows how much of these requirements can be met from British production. From these can be deduced the contribution which is required of the United States. No estimate is made of the United States own requirements.

AIR REQUIREMENTS.

(c) In Annex III will be found figures showing the total joint air forces required in British and United States areas of responsibility. To these are attached figures which show the aircraft required to meet the purely British target programme, and a forecast of United Kingdom aircraft production. From these can be deduced the number of aircraft which are required of the United States by the British. The figures of the estimate of United States aircraft requirements have been prepared and are available in Washington.

MERCHANT SHIPPING REQUIREMENTS.

(d) In Annex IV will be found the overall requirements of the British Mercantile Marine. Figures are given showing British requirements of the United States. No mention is made of the United States own requirements.

It will be appreciated that, in a paper of this nature, only certain major items of equipment can be dealt with, but these give a measure of the production capacity which is required. The adjuncts and accessories which are in proportion to the principal items can be tackled at a later stage, when the main framework of the programme has been settled.

6. We have considered the question of priorities, which must clearly be based on strategical considerations. We can say at once that the security of the sea communications and the provision of merchant shipping for the maintenance of our respective war efforts and for the transportation of forces and equipment to the active theaters of war will be an overriding factor, which will dictate a high priority for certain of these requirements. Similarly, if we are to prepare Germany for the final blow, the production of overwhelming air forces will be essential, and these must clearly also be allotted a high degree of priority. Nor must a proportion of the production of tanks be allowed to suffer. We are convinced, however, that it

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would be a mistake at this stage to attempt to lay down an order of priority for all these requirements. In the first place, they are not complete as the United States requirements have not been included. In the second place, we would emphasise that the estimates we have made are only in a preliminary stage. They represent what we should like, but we recognise that, when they have been examined by the Production Authorities, considerable modification may well be necessary. We feel that the question of more detailed priorities can only be tackled when the figures have been related to the realities of production and can be regarded as firm. Meanwhile, the most we can do is to place on record our views on the priorities which we think should be allotted in---

(a) The production of aircraft.
(b) The production of merchant shipping and certain Naval vessels.

These we attach at Annex V. It should be clearly understood that these priorities are incomplete. The Naval and Air priorities have not been related to each other and the Army priorities have not been drawn up.

RECOMMENDATIONS.

7. We recommend the following procedure in order to present a full picture of the overall victory requirements:—

(a) Full United States requirements should be added to the British or joint figures given in the Annexes to this paper. The basis of estimation must, of course, be similar in each case.

(b) The estimate of what is required to maintain Russian resistance should be added after the return of the delegations from Moscow.

(c) The resultant totals, after deduction of British estimated production, should be referred to the Production Authorities in the United States, who should be asked to say how far these requirements can be met, within the time limits, and to what extent the demands for various items seriously conflict one with another.

(d) The modifications necessary to relate the total programme to the realities of United States and British Empire industrial production, to adjust any serious conflicts, and to fix relative priorities in greater detail, should be discussed between the United States and British Staffs in Washington and determined on a strategical basis.

8. In view of the urgency of the time element we recommend most strongly that the procedure proposed in 7 (a) and (c) above should be initiated at once, without waiting for the results of the Russian conference.

(Signed) E. G. H. HELLARS. J. T. McNARNEY.
V. DYKES. R. S. WENTWORTH.
W. F. DICKSON. F. P. THOMAS.
C. H. BUNDY.

Great George Street, S. W. 1,
September 19, 1941.

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INDEX TO ANNEXES AND ENCLOSURES.

	Page
Annex I.—Naval requirements	5
Enclosure 1 to Annex I.—Estimated Overall Production Requirements of the Royal Navy	6
Enclosure 2 to Annex I.—Estimated Overall Production Requirements in Aircraft of the Fleet Air Arm	7
Annex II.—Army Requirements	9
Enclosure 1 to Annex II.—Estimate of Land Forces required in areas of British strategic responsibility ...	10
Enclosure 2 to Annex II.—Estimated Equipment Requirements of those Forces in Enclosure 1 which can be found from British resources	11
Enclosure 3 to Annex II.—Forecast of British Empire Production in the items listed in Enclosure 2 to Annex II in the period September 1, 1941 to June 30, 1943 ...	12
Annex III.—Air Requirements	15
Enclosure 1 to Annex III.—First Line Operational Air Requirements—Joint Levels to be attained by July 1, 1943	16
Enclosure 2 to Annex III.—Numbers of aircraft required to build up the First Line Strength in the purely British part of the target programme outlined in Enclosure 1 to Annex III	17
Enclosure 3 to Annex III.—Forecast of the United Kingdom Aircraft Production Programme(Provisional) within period October 1, 1941, and July 1, 1943	17
Annex IV.—Merchant Shipping	19
Enclosure to Annex IV.—British Requirements in Merchant Shipping	20
Annex V.—Priorities—general expression of views on the priorities which should be allotted in:—	21
(a)—the production of aircraft;	
(b)—the production of merchant shipping and certain Naval vessels.	

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ANNEX I.

OVERALL REQUIREMENTS OF THE ROYAL NAVY AND FLEET AIR ARM.

1. In the attached Enclosure 1 the position regarding British Naval shipbuilding is set out and an estimate is made (Column 12) of British requirements in the United States if deficiencies are to be made good.

2. The requirements of Tank Landing Craft are provisionally estimated at 1,300 by the 1st July, 1943. Production in the United Kingdom is at present carried out by firms other than shipbuilders. Construction of Tank Landing Craft in the United States would involve shipment to the United Kingdom which only a limited number of merchant vessels can undertake. The expansion of landing craft production can, therefore, best be undertaken in the United Kingdom, although assistance in the provision of engines from the United States will be necessary. Some reduction in merchant shipbuilding in the United Kingdom might ensue, and this would involve a corresponding increase in American production. The estimated requirement of ocean-going tank landing ships (as opposed to the smaller tank landing craft types) will be met from the present programme of construction in Great Britain and the United States.

3. The requirements in aircraft of the Fleet Air Arm are set out in Enclosure 2.

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ENCLOSURE 1 to ANNEX I.

OVERALL REQUIREMENTS OF THE ROYAL NAVY.

1	2	3	4	5	6	7	8	9	10	11
Category.	Total British requirements	Losses to date	Annual rate of loss and replacement.	Losses by	Total required by	Now in service June 1941	British building by Jan.1943	Annual rate of British building.	Total British building from Jan.1943 to—	Total by British effort by—
				Columns 2 & 5						Columns 7&8&10
Battleships	18	2	1	Jan.1947 5	Jan.1947 23	15	3	1-2	Jan.1947 5	Jan.1947 23
Aircraft Carriers	14	2	1	5	19	9	1	1-2	5	15
Aux.Aircraft Carriers	12	Nil	1	5	17	1	Nil	Nil	Nil	1
8-in.Cruiser(Heavy)	20	1	½	3	23	14	Nil	1	4	18
6-in.Cruiser(Heavy)	40	4	2	11	51	23	6	5-5	22	51
Cruisers (Light)	40	2	1	5	45	23	(34 later)	Nil	Nil	34
Destroyers	280	53	57	Jan.1944 128	Jan.1944 408	245	68	40	Jan.1944 40	Jan.1944 353
Submarines	132	37	29	65	197	81	36	40	40	157
Depot and Repair Ships	27	Nil	2/3	2	29	20	5	2	2	27
Escorts	680	19	15	35	715	163	82	60	60	305
Naval Coastal Frontier Forces	3,000	?	250	560	3,560	1,450	900	600	600	2,950
Naval Harbour and Local Defence Forces	Not calculated	...	...	...	...	...	...	...	...	...

Tank Landing Craft — 1,300(bylst July,1943)

Ocean-Going Tank Landing Ships — 13 (7 now on order in U.S.A. Remainder complete or under construction in U.K.)

Notes:— (i) In the case of light craft the date 1944 has been chosen since these craft are required urgently for strategic r

(ii) Naval Coastal Frontier Forces—

Sloops, L. D.
Corvettes, L.D.
Fleet Minesweepers
Moored Minesweepers.
Magnetic Minesweepers
A/S Trawlers and local craft.
Coast Minelayers
Eagle Ships
M.T.Bs., M.G.Bs., & c.

(iii) Naval Harbour and Local Defence Forces.—Boom Gate Vessels. 72 ft. H.L.s. Utility Craft.

(iv) The figures in column 4 against destroyers, submarines and escorts allow for replacement of over-age tonnage dur

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OSURE 1 to ANNEX I.

IREMENTS OF THE ROYAL NAVY.

8	9	10	11	12	Desired from the United States.									
British building by Jan.1943	Annual rate of British building.	Total British building from Jan.1943 to—	Total by British efforts by—	Total deficiencies.	July 1942	Jan. 1943	July 1943	Jan. 1944.	July 1944	Jan. 1945	July 1945	Jan. 1946	July 1946	Jan. 1947
			Columns 7&8&10	Columns 6-11										
		Jan.1947	Jan.1947											
3	1-2	5	23	Nil	...	...	...	Nil	...	...	...	...	...	...
1	1-2	5	15	4	...	...	...	...	...	2	...	2	...	... 4
Nil	Nil	Nil	1	16	6	3	3	1	1	...	1	...	1	... 16
Nil	1	4	18	5	...	...	...	...	...	...	1	2	2	... 5
6	5-5	22	51	Nil	...	...	...	...	...	...	...	...	...	...
(284 later)	Nil	Nil	34	11	...	...	...	3	3	3	2	1	1	... 11
		Jan.1944	Jan.1944							5				
68	40	40	353	55	...	...	10	20	20	20	5	} 55		
36	40	40	157	40	...	10	10	10	10	10	...	} 40	Thereafter as necessary to replace deficiencies.	
5	2	2	27	2	...	1	...	1	...	...	...	} 2		
82	60	60	305	410	...	50	100	100	100	60	60	} 410		
900	600	600	2,950	610	100	150	150	150	60	60	...	} 610		
...	...	...	...	None required from U.S.A.										

struction in U.K.)

hese craft are required urgently for strategic reasons and have a short building period.

rs.
pers
local craft.
2 ft. M.L.s.
s allow for replacement of over-age tonnage during the years 1942-43

Coast Minelayers
Eagle Ships
M.T.Bs.,MgG.Bs., & c.
Utility Craft.

110 ft. M.L.
Seagoing tugs.
Salvage Vessels

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OVERALL REQUIREMENTS IN AIRCRAFT OF THE FLEET AIR ARM.

1. The requirements in aircraft of the Fleet Air Arm for production of aircraft in the United States during period the 30th September, 1941, to the 31st March, 1943, are as follows:—

Torpedo Scout Reconnaissance Aircraft	1,700
Light Reconnaissance	150
Fighters	1,240
Total single engine aircraft	3,090

2. These aircraft are desired in the following priority:—

Fighters	400	) Already ordered or under negotiation. These are required on a very high priority.
Torpedo Scout Reconnaissance	200	)
Light Reconnaissance ...	120	)
Air Reconnaissance ...	30	
Fighters	~~800~~ 840	
Torpedo Scout Reconnaissance	1,500	
Total	3,090	single engine aircraft

3. The above requirements do not include land-based torpedo aircraft or flying boats, the requirements for which are included in the Royal Air Force figures.

4. No allowance has been made in the above for aircraft required for carriers completing after the 31st March, 1943.

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WAR CABINET.

CONFERENCE ON BRITISH-UNITED STATES PRODUCTION.

CORRIGENDA TO B.H. (41) 14.

(also circulated as C.O.S.(41) 215(0)).

It is requested that the attached revised Annex II and Enclosures 1, 2 and 3 may be substituted for the existing Annex II and Enclosures 1, 2 and 3.

2. It will be seen that Amendments have been made to Enclosures 2 and 3 only. Annex II and Enclosure 1 are identical and have only been reprinted for convenience.

3. All copies of the original Annex II should be returned to the War Cabinet Offices.

(Signed) A.T. CORNWALL-JONES.

Great George Street, S.W.1.

26th September, 1941.

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ANNEX II.

Army Requirements.

In the attached Enclosures are set out:—

Enclosure 1.

An estimate of the land forces required in the areas of British strategic responsibility.

Enclosure 2.

An estimate of the quantities of certain major items estimated to be required for all forces in British areas of strategic responsibility which the British can man from their own resources.

Enclosure 3.

A forecast of British Empire production in the items referred to in Enclosure 2.

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Enclosure 1 to Annex II.

ESTIMATE OF LAND FORCES REQUIRED IN AREAS OF BRITISH STRATEGIC RESPONSIBILITY.

Formation or Unit	United Kingdom.	Northern Ireland.	Middle East and Iraq / Palestine,	Malaya.	India, Burma, Ceylon	East Africa.	West and N.W. African.	Australasia, Fiji, New Guinea.	Iceland (C) Faroes.	Malta Gibraltar, Hong Kong.	Total	Remarks
Armoured Division ...	8	...	11	...	1	...	3	1	...	...	24	(a)
Cavalry Division ...	...	...	...	...	..	...	...	2	...	...	2	Includes
Armoured Regiment ...	...	...	...	2	...	...	...	...	...	...	2	12 county
Army Tank Brigade ...	..6	1	4	...	1	...	1	...	...	...	13	Divisions
Corps H.Q...	6	1	5	1	2	...	2	1	...	...	18	(b)
Infantry Division ...	24(a)	3	14	4	6	...	3	4	1	...	59	Includes
Infantry Brigade ...	5	...	...	...	...	...	...	3	...	...	8	an extra
Independent Infantry Brigade Group	3	1	...	...	5	9	6	1	1	...	26	262 Heavy and 280
Infantry Battalion ...	...	..3	...	13	114	...	5	24	2	24	185 plus 123,800 men	Light AA. guns for the
Training as Garrison Battalion	123,800 men											Atlantic Islands and South African ports.
Heavy A.A. Guns ...	4,660	290	1,600	176	396	...	256	350	96	518(b)	8,342	
Light A.A. Guns ...	5,850	542	2,798	328	814	108	646	1,022	132	520(b)	12,760	

NOTE.--Existing British land forces are included in the above figures.

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Enclosure 2 to Annex II.

ARMY REQUIREMENTS.

1. Paragraph 3 contains the quantities of certain major items estimated to be required for all forces in British areas of strategic responsibility, which the British can man from their own resources. It therefore omits the requirements of Canadian Home Defence Forces.

2. The basis of estimation is as follows:--

(a) Allowance is made for--

(i) Complete unit equipment and appropriate reserves, according to the actual and prospective theatres of employment.

(ii) Estimated war wastage between the 1st July, 1941, and the 30th June, 1943, according to the degree of operations anticipated in the various theatres.

(b) To arrive at the net requirements, that is the quantities of each item required to be delivered between the 1st July, 1941, and the 30th June, 1943, account has been taken of British pre-war stocks and of receipts and wastage between the beginning of the war and the 30th June, 1941. (In the case of ammunition, stocks at the 31st December, 1940, and receipts and expenditure between that date and the 30th June, 1941.)

(c) No account has been taken of Indian and Dominion pre-war stocks, nor of Indian and Dominion production on their own account between the beginning of the war and the 30th June, 1941. To this extent, the figures shown below will be an over-estimate, but it is probable that, as regards India and the Dominions (other than Canada), the only considerable asset in respect of modern equipment from these sources will be in rifles, which will almost certainly be required for local forces.

(d) No provision whatever is made for operational wastage after the 30th June, 1943. It is assumed that the productive capacity available by that date will amply suffice for making good this wastage.

(e) The above remarks do not altogether apply in the case of transportation and heavy engineering equipment, since the requirements in these classes of stores are governed as much by the prevailing conditions in the theatres of operations as by the size of the force involved. The quantities given under (c) below represent, on the information available, the best estimate of requirements that can be made on the above broad lines for theatres of war in undeveloped countries where port and transportation development on a major scale is required.

(f) Finally, an allowance has been made for the arming of "Patriot Forces."

3. The figures are as follows:--

(a) Weapons.

1. Tanks (Infantry (7,700), Cruiser (17,600), Light (2,700))	28,000
2. Armoured Cars (3,500) and Lt. Recce. Cars (5,500)	9,000
3. Light A.A. Equipments	12,000
4. Heavy A.A. Equipments	7,200
5. Anti-Tank Equipments	22,500
6. Fd. Army Artillery--	
Field	7,000
Medium	1,700
Heavy	340
7. Rifles	2,750,000*
8. Rifles Anti-Tank...	75,000
9. Brens	175,000
10. Tank Transporters and Recovery Transporters ...	8,400

* To some extent, sub-machine guns can be regarded as being in aid of this requirement.

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(b) Ammunition—	
11. Tank and Anti-Tank gun Ammunition (1,000's) ...	45,000
12. S.A.A. (millions)	4,350*
13. A.A. Ammunition Light (1,000's)	27,000
Heavy (1,000's)	21,000
(c) Transportation and Heavy Engineering Equipment (Additional requirements from 1st September, 1941).	
14. Locomotives standard gauge—	
(a) Steam	316†
(b) Diesel	72
15. Rolling stock standard gauge (10-ton units) ...	26,000
16. Permanent way material all gauges (miles)	1,050
17. Cranes—	
(a) Wharf and railway	255
(b) Mobile up to 5-ton	100
18. Tractors for mechanical plant (some armoured) ...	1,300
19. Excavators	460
20. Charging and Generating Sets up to 12 K.W.... ...	10,000
21. Water/oil pipe up to 12" with fitting (miles) ...	6,000
22. Pumps, power driven, 2"-10"	2,500
23. Pumps, oil refinery and pipeline, various	100
24. Petrol tin making and filling factories complete	12
25. Barrel making and filling plants complete	6

* Excluding sub-machine gun and pistol.

† Over and above the 150 release of which from United Kingdom railways has recently been agreed upon.

REQUIREMENTS FOR UNITED STATES LAND FORCES.

4. The requirements of the United States land forces, estimated on a basis similar to that described in paragraph 1, are not available in London.

5. The forces which the British can man from their own resources will not suffice to cover the total estimated in Enclosure 1 to Annex II as necessary for victory in the British areas of responsibility. The requirement figures to allow for this deficiency have been worked out (on British basis of calculation) and are in possession of the United States Representatives. Any necessary adjustment can thus be readily made to the figures of the total requirements of the United States land forces.

Enclosure 3 to Annex II.

FORECAST OF BRITISH EMPIRE PRODUCTION.

The total estimated production from British Empire sources from the 1st September, 1941, to the 31st March, 1943, in the items listed in paragraph 3 of Enclosure 2 to Annex II is as follows:—

(1) This antedate allows for the time lag between factory production and the date when armaments are effectively in the hands of formed units; due to final inspection, transit (which for a proportion of our supplies means sea as well as land transportation) and the matching with complementary arms, spares, &c. It is not unreasonable to assume that the requirements indicated to the end of June 1943 should be produced by the end of March 1943.

(2) The forecasts of production make some provision for losses in ocean transit or interruption of British production due to enemy action. The discount is moderate (10 per cent.), but we cannot allow for the loss by destruction of vital plants.

(3) Even when production appears to go a long way towards meeting the total British requirements, there will be a great deficiency in most items during the first half of the period.

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Tanks	16,900	Changes in design, which will probably be necessary during the next two years, would naturally reduce the total production. To keep pace with tank bodies, .303 M.G.s from United States production will have to be used in place of medium Besas in a considerable number of British-built tanks.
Armoured Cars	3,600	...
Reconnaissance Cars ...	5,100	...
Light A.A. Equipments	10,300	...
Heavy A.A. Equipments	3,800	...
Anti-Tank Equipments	13,500	If, owing to an increase of armour in enemy tanks, a higher proportion of heavier anti-tank weapons has to be produced, this estimate will not be realised.
Field Army Artillery—		
Field	7,000	...
Medium	800	...
Heavy	200	...
Rifles, .303	1,100,000	...
Rifles, anti-tank ...	66,000	...
Brens	135,000	
Ammunition—		
Tank and Anti-tank (1,000's)	32,000	Gun supply from Empire sources is also below requirement.
A.A. Light (1,000's)	24,000	
A.A. Heavy (1,000's)	15,000	

S.A.A. The production of S.A.A. for .303 and Besa guns will cover requirements, but we have been depending almost entirely on United States production for .30 and .45.

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TABLE I

Requirements for British Forces to mid 1943 and British Empire Production to the end March 1943.

Armoured Fighting Vehicles	Requirement to mid 1943	Empire Production to end March 1943
Cruiser and Light Tanks	28,000	16,500
Light Reconnaisance Cars	5,500	5,100
Armoured Cars	3,500	3,600
Artillery		
Field Guns	7,000	6,500
Medium Guns	1,700	800
Heavy Guns	340	200
Anti-Tank Guns (6pdr. and heavier)	13,000**	7,000
A.A. Guns Light	12,000	10,300
-do- Heavy	7,000	3,800
Small Arms		
Rifles	2,750,000	1,100,000
Light Machine Guns (Bren)	175,000	135,000
Anti-Tank Rifles	75,000	66,000
Tank Weapons		
For U.S. output of Cruiser and Light Tanks	To balance output of U.S. tanks	Nil.
For British & Canadian Output of British type Tanks		
Guns	16,500	18,500
Machine Guns	27,000	16,000
For Canadian output of M.S. Tanks		
Guns	For 750 Tanks	Nil.
Machine Guns	3,000	Nil.
Wheeled Vehicles (for the Army)		
Motor Cycles (Solo & Combination)	230,000	126,000
Trucks, Lorries (up to 3 ton) and Light Tractors	327,000	276,000
Lorries 6 and 10 ton	7,500	2,100
Heavy Tractors	16,000	3,300
Transporters and Recovery Vehicles	8,400	700

** Under consideration.

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ANNEX III.

Overall Requirements in Air Forces.

1. In the attached enclosures are set out:—

Enclosure 1.
The Joint levels in first line air forces to be attained by the 1st July, 1943.

Enclosure 2.
The totals of the numbers of aircraft in each class which it will be necessary to produce between the 1st October, 1941, and the 1st July, 1943, in order to build up the first line strength required in the British target programmes.

A note showing where the equivalent United States figures can be found.

Enclosure 3.
Forecase of U.K. aircraft production programme (provisional) within the period the 1st October, 1941, and the 1st July, 1943.

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A.D.F. Sets.	
Various Equipments.	3,500
I.F.F. Sets	3,500
W/T Equipment (complete)	
For Capital Ships Cruisers etc.	30
For Destroyers, Corvettes etc.	1,000
For Small Craft	Figures not available
For Landing Craft (portable sets)	1,500
A/S Sets.	2,000
Depth Charge Equipment.	
Rails	3,500
Chutes	3,200
Throwers	3,500
Depth Charges	260,000
New type ahead throwers	500
Charges for ahead throwers	90,000

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APPENDIX "BB".

NAVAL AIRCRAFT REQUIRED IN BRITISH AREAS OF RESPONSIBILITY

	I. First Line.	II. First Line Reserve.	III. Training	IV. Training Reserve.	V. Strategic Reserve.
Torpedo Bomber Reconnaissance.	435	652	263	132	1,500
Amphibian Bomber Reconnaissance.	120	180	57	28	-
Light Reconnaissance.	34	51	10	5	-
Fighters Single and two Seaters.	336	504	132	66	800

NOTES: (i) Column I. First Line means operational aircraft with full operational crews available.

(ii) Column II. First Line Reserve means all aircraft not actually available for flying due to repairs or non-provision of crews.

(iii) Existing British naval aircraft are included in the above figures.

TABLE "BB".

NAVAL AIRCRAFT.

The figures given below indicate the approximate totals of the number of aircraft and certain other critical items of connected equipment which it will be necessary to produce by 31st March, 1943, in order to meet the requirements in naval aircraft as shown in Appendix B above.

A. Aircraft.

Torpedo Bomber Reconnaissance	3,250
Amphibian Bomber Reconnaissance	420
Light Reconnaissance	120
Fighters (all types)	1,930

B. Wireless Sets.

(Including R/T. W/T Homing Beacon and R.D.F. sets	21,000

C. Machine Guns. (0.303, 0.50 and 20mm) 21,000

Note: The above two figures (B and C) do not include Maintenance spares, salvage should meet W/T maintenance requirements and 25% has been allowed for Machine gun spares.

D. Bombs.

500 lbs.	(Armour piercing)	1,800
250 Lb.	(" ")	11,500
250 lb.	(General Purposes)	11,500
40 lb.	(" ")	53,000
25/40 lb.	Incendiary	32,000
Depth Charges		7,000

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Appendix C.

Army - Summary of Target Orders of Battle

Formation or Unit	U.K.	Northern Ireland	Middle East and Iraq Palestine	Malaya	India, Burma, Ceylon.	East Africa.	West & N. W. Africa.	Australasia, Fiji, New Guinea	Iceland (c) Faroes.	Malta, Gibraltar Hong Kong	Total	REMARKS
Armoured Div.	8	-	11	-	1	-	3	1	-	-	24	(a) Includes 12 county divs.
Cavalry Div.	-	-	-	-	-	-	-	2	-	-	2	
Armoured Rgt.	-	-	-	2	-	-	-	-	-	-	2	
Army Tank Bde.	6	1	4	-	1	-	1	-	-	-	13	
Corps H.Q.	6	1	5	1	2	-	2	1	-	-	18	(b) Includes as extra 262 Hy. and 280 Lt. A.A. guns for the Atlantic Islands and South African ports.
Infantry Div.	24(a)	3	14	4	6	-	3	4	1	-	59	
Inf. Bde.	5	-	-	-	-	-	-	3	-	-	8	
Independent Infantry Bde. Gp.	3	1	-	-	5	9	6	1	1	-	26	
Inf. Bn. Training as garrison bn.	123,800 men	3	-	13	114	-	5	24	2	24	185 plus 123,800 men	
Hy. A.A. guns	4,660	290	1,600	176	396	-	256	350	96	518 (b)	8,342	
Lt. A.A. guns	5,850	542	2,728	328	814	108	646	1,622	132	520 (b)	2,760	

Note. Existing British land forces are included in the above figures.

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TABLE C.

ARMY REQUIREMENTS.

1. The amount of equipment involved to equip and maintain the forces listed in Appendix C above is obviously considerable. We give below some approximate idea of the quantities in respect of a few representative typical items. The basis on which we have estimated these quantities is as follows:-

(a) For the existing forces we have allowed for:

(i) The complete unit equipment and the appropriate reserves according to theactual and prospective theatres of employment;

(ii) the estimated war wastage between 1.7.41 and 31.3.43. according to the degree of operations anticipated in various theatres.

(b) For the additional forces, i.e. those in Appendix C not previously provided for, we have estimated the unit equipment required plus the appropriate scale of reserves, but we have not allowed for any operational wastage prior to 31.3.43.

(c) To arrive at the net requirement, that is the quantities of each item required to be delivered between 1.7.41 and 31.3.43, we have taken account of His Majesty's Government pre-war stocks and of receipts and wastage between the beginning of the war and 30.6.41. (In the case of ammunition, stocks at 31.12.40 and receipts and expenditure between that date and 30.6.41.)

(d) We must point out that we have not taken into account U.S.A. stock and we have no precise knowledge of Indian and Dominion pre-war stocks nor of Indian and Dominion production on their own account between the beginning of the war and 30.6.41. To this extent the figures shown below will be an over-estimate. But it is probable as regards India and the Dominions that in respect of modern equipment the only considerable asset from this source will be in Rifles, and as against this must be set the Home Guard or equivalent requirements of India and the Dominions which do not appear in Appendix C and are nevertheless a genuine requirement.

(e) Taking all things into consideration therefore we consider that the figures given below represent a reasonable estimate of the deliveries of equipment which would be required between 1.7.41 and 31.3.43 in order to ensure that the existing forces are maintained until the latter date and that at the latter date the whole force shown in Appendix C is completely equipped with the necessary reserves, and in a position to undertake active operations on 1st April 1943. But it must be emphasized that the sub-joined quantities make no provision whatever for operational wastage after 31.3.43.

2. The above remarks do not altogether apply in the case of transportation and heavy engineering equipment since the

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requirements of these classes of store are governed as much by the prevailing conditions in the theatre of operations as by the size of the force involved. The quantities given under (c) below represent, on the information available, the best estimate of requirements that can be made on the above broad lines.

3. The figures are as follows: -

(a) Weapons.

1.	Tanks (Infantry (7,300) Cruiser (21,600) Light (2,600))	31,500
2.	Armoured Cars (4,200) and Lt. Recce. Cars (5,500)	9,700
3.	Light A.A. Equipments	12,500
4.	Heavy A.A. Equipments	7,300
5.	Anti-Tank Equipments	21,500
6.	Fd. Army Artillery Field	8,500
	medium	2,000
	heavy	400
7.	Rifles	2,900,000 *
8.	Rifles Anti-Tank	90,000
9.	Brens	170,000
10.	Tank Transporters and Recovery Transporters	9,000

* To some extent Sub-machine guns can be regarded as being in aid of this requirement.

(b) Ammunition.

11.	Tank and Anti-Tank gun Ammunition (1000s)		45,000
12.	S.A.A.	(millions)	4,500 ∮
13.	A.A. Ammunition Light	(1000s)	27,500
	heavy	(")	20,000

∮ Excluding Sub-machine gun and Pistol.

(c) Transportation and Heavy Engineering Equipment. (additional requirements from 1.9.41.)

14.	Locomotives standard gauge	
	- a - Steam	316 ∮
	- b - Diesel	72
15.	Rolling stock standard gauge (10 ton units)	26,000
16.	Permanent way material all gauges (miles)	1,050
17.	Cranes	
	(a) Wharf and railway	255
	(b) Mobile up to 5-ton	100
18.	Tractors for mechanical plant (some armoured)	1,300
19.	Excavators	460
20.	Charging and Generating Sets up to 12 K.W.	11,000
21.	Water/oil pipe up to 12" with fitting (miles)	6,000
22.	Pumps power driven 2" - 10"	2,500
23.	Pumps, oil refinery and pipe-line, various	100
24.	Petrol tin making and filling factories complete	12
25.	Barrel making and filling plants complete	6

∮ Over and above the 150 the release of which from U.K. Railways has recently been agreed upon.

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Home Guard and Aerodrome Defence in United Kingdom

4. This liability does not appear in Appendix C and its requirements are therefore not included in the above quantities. To take two examples, the Home Guard could well absorb: -

Rifles	500,000
S.A.A.	300,000,000

Special Operations and Patriot Armies.

5. It is estimated that by 31.3.43 the following weapons etc., not included in the foregoing figures, may be required for these purposes: -

Rifles	300,000
L.M.G.s	40,000
S.A.A.	130,000,000
A/Tank Equipments	2,500
A/Tank Ammunition	1,250,000

6. It is possible that the general strategic situation may admit of some reduction in Home Guard and Aerodrome Defence in United Kingdom by the spring of 1943. To the extent that this may be found practicable the equipment etc. thus released can be used in aid of the liabilities in paragraph 5 above.

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APPENDIX B. FIRST LINE AIR REQUIREMENTS.

	Heavy Bomber.	Medium Bomber	Light Bomber.	S.E. Fighters	M.E. Fighters	G.R.Land Planes Medium Type	Torpedo Bombers	Flying Boats	Transport Aircraft.	REMARKS
Metropolitan Air Forces.										
Bomber Command	5,724	144	440(a)							(a) these include reconnaissance aircraft to meet Army requirements.
Fighter Command				1,624(a)	480					
Coastal Command	200(b)				128	256(b)	128	117		(b) When Bomber Command requirements of Heavy Bombers are completed, 200 of these G.R. land planes will be replaced by Heavy Bombers.
Photographic Reconnaissance.				20	60					
Middle East	* 80	240	248	744	260	84	42		500	* Facilities for operating further 240 heavy bombers.
West African.	*	32	60	92		28		12		* Facilities for 80 Heavy Bombers.
India.	*		104	168	32	28			16	* Facilities for 64 Heavy Bombers.
Far East.	*	128	56	216	124	126	56	42	32	* Facilities for 64 Heavy Bombers.
Dominions. Australia		128	12	12	32	168		12	20	
New Zealand			44	32		56		6		
South Africa						60			35	
	5,004	672	964	2,908	1,116	806(b)	226	189	603	

(Note (i) Existing British Air Forces are included in the above figures.

(ii) It should not be assumed that the above allotment of air forces is in any way static. In making these estimates, allowance has been made for strategic flexibility.

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TABLE "D".

AIR FORCE REQUIREMENTS

The figures given below give the approximate totals of the numbers of aircraft it will be necessary to produce between the period 1st October 1941 and 31st March, 1943, in order to build up to the first-line strength required to meet the British estimate of the joint military requirements in air forces in the areas in which the British assume responsibility, as set out in Appendix "D" above.

Heavy Bombers	13,500
Medium Bombers	5,500
Light Bombers	5,500
Single-engine Fighters	13,500
Multi-engine Fighters	4,000
G.R. Landplanes	1,500
Torpedo Bombers	800
Flying Boats	500
Transport aircraft	1,500

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S E C R E T

W.M. (41) 13.

COPY NO. 51

18TH SEPTEMBER, 1941.

CONFERENCE ON BRITISH-UNITED STATES PRODUCTION

Note by the Secretary.

It has been learnt that the composition of the Russian Delegation to the forthcoming conference is as follows:-

Head of Delegation.
M. Molotov

Members.

Marshall Voroshilov	
M. Mikoyan	Peoples Commissar for Foreign Trade.
M.M. Lyshev	Peoples Commissar for Medium Machinery construction.
Admiral Kuznetsov	Peoples Commissar for the Navy.
M. Shakhyrin	Peoples Commissar for Aircraft Industry.
General of Artillery Yakovlev	Head of Main Artillery Administration of the Peoples Commissariat of Defence.

(Signed) E.I.C. JACOB.

Great George Street, S.W.1.,

18TH SEPTEMBER, 1941.

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MEMORANDUM: Ultimate Requirements — Ground Forces.

1. To facilitate the War Department's presentation of information pertaining to the production capacities (rates) required for an all-out effort to defeat the Axis Powers, the following assumptions have been made and should serve as bases for related studies and computations:

a. All requirements will be based on monthly production rates determined by the factors indicated below. (These requirements will be calculated for every six months' period beginning January 1, 1942, on the troop basis shown in paragraph c below).

(1) Quantities expressed in terms of critical items required to equip prescribed forces in increments.

(2) Quantities expressed in terms of critical items required to maintain forces in theatre of operations (based on accepted attrition rates).

(3) The equipment for each increment (force) will be provided six months prior to the time it is to be employed in a theatre of operations.

b. Six months (3 turnarounds for European Theatre) will be considered sufficient time for the transportation of each increment.

c. The forces indicated in Tab A attached will be identified as follows:

Increment 1. Forces distributed in the military bases, outlying possessions and the potential task forces indicated for employment in Brazil, Colombia, Peru, and Ecuador, totaling approximately 500,000.

Increment 2. Forces indicated in the Third Army totaling approximately 500,000.

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Increment 3. Forces indicated in the First Army totaling approximately 750,000.

Increment 4. Forces indicated in the Fourth Army totaling approximately 750,000 men.

Increment 5. A force of approximately 1,000,000 men taken from the strategic reserves.

Increment 6. A force of approximately 1,000,000 men taken from the strategic reserves.

Increment 7. A force of approximately 1,000,000 men taken from the strategic reserves.

2. Applying the assumptions stated in Paragraph 1 above to the total ultimate requirements for ground forces indicated in Tab A, the Office of Production Management should be requested to create and coordinate the operation of a production capacity in our country that will initially equip and then sustain the increments (forces) in combat on the dates indicated below:

On January 1, 1942

Equipped and in Theatre of Operations

	Approximate Number
Increment 1.	500,000
Equipped Only	
Increment 2. (preparing for theatre)	500,000

On July 1, 1942

Equipped and in Theatre of Operations

Increment 1.	500,000
Equipped Only	
Increment 2. (starts moving into the theatre)	500,000
Increment 3. (preparing for theatre)	750,000
Total Equipped	1,250,000

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On January 1, 1943

Equipped and in Theater of Operations

Increment 1.	500,000
Increment 2.	500,000
Total in Theater	1,000,000

Equipped Only

Increment 3. (starts moving into the theater)	750,000
Increment 4. (preparing for theater)	750,000
Total Equipped	1,500,000

July 1, 1943

Equipped and in Theater of Operations

Increment 1.	500,000
Increment 2.	500,000
Increment 3.	750,000
Total in Theater	1,750,000

Equipped Only

Increment 4. (starts moving into Theater)	750,000
Increment 5. (preparing for theater)	1,000,000
Total Equipped	1,750,000

January 1, 1944

Equipped and in Theater of Operations

Increment 1.	500,000
Increment 2.	500,000
Increment 3.	750,000
Increment 4.	750,000
Total in Theater	2,500,000

Equipped Only

Increment 5. (starts moving into the Theater)	1,000,000
Increment 6. (preparing for theater)	1,000,000
Total Equipped	2,000,000

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July 1, 1944

Equipped and in Theater of Operations

Increment 1.		500,000
Increment 2.		500,000
Increment 3.		750,000
Increment 4.		750,000
Increment 5.		1,000,000
	Total in Theater	3,500,000

Equipped only

Increment 6.	(starts moving into the theater)	1,000,000
Increment 7.	(preparing for theater)	1,000,000
	Total Equipped	2,000,000

January 1, 1945

Equipped and in Theater of Operations

Increment 1.		500,000
Increment 2.		500,000
Increment 3.		750,000
Increment 4.		750,000
Increment 5.		1,000,000
Increment 6.		1,000,000
Increment 7.		1,000,000
	Total in Theater	5,500,000

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ULTIMA[illegible] STRATEGY

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ASSUMPTIONS

I. That the world situation as of July 1, 1943 will be approximately as follows:

1. Russia is considerably weakened militarily in Europe. Resistance in Siberia, to include Maritime Provinces, continuing.

2. The axis military strength is materially weakened through economic blockade; by losses in the Russian campaign; by British air and sea operations; by the inability to exploit quickly the extensively sabotaged Russian industries and raw materials; by lowered morale of the people.

3. The military forces of Japan are fully involved with or contained by campaigns against a somewhat strengthened China, by the Russian forces in the Far East Maritime Provinces, or by the threat of United States - British military and economic reprisals.

4. Great Britain and associates have increased their fighting forces by creating and equipping additional combat units.

5. The French continue their passive collaboration with Germany.

6. Control of the Mediterranean Theater, including North Africa and the Near East, remains disputed.

7. The United States is an active belligerent and is collaborating, militarily and economically with Great Britain and associates in an all-out effort to defeat Germany.

II. That before ground operations are undertaken in Continental Europe, the following conditions must be created by our sea and air forces in collaboration with the British and Associated Powers:

1. The surface and subsurface vessels of the Axis must be swept from the seas, particularly in the Atlantic and water areas contiguous to Europe.

2. Overwhelming air superiority must be accomplished.

3. The economic and industrial life of Germany must be rendered ineffective through the disruption and destruction of lines of communications, of port and industrial facilities, and by the interception of raw materials.

4. The combat effectiveness of the German air and ground units must be weakened by overextension, dispersion, and shortage of materiel, including fuel.

5. Popular support of the war effort by the peoples of the Axis Powers must be weakened and their confidence shattered by subversive activities, propaganda, deprivation and the destruction wrought.

III. That the scope and nature of the military operations necessary to defeat the Axis Powers cannot be predicted at this time, but we must prepare to fight Germany by actually coming to grips with and defeating her ground forces and definitely breaking her will to combat.

IV. That the establishment of effective military bases, encircling the Nazi citadel, must be undertaken as appropriate means become available and when favorable conditions are created for the operations involved.

ULTIMATE GOAL - GROUND FORCES

I. Based on the foregoing assumptions, and on the military operations deemed necessary for the realization of our national objectives, a production capacity must be created to accomplish the following:

1. To assist Great Britain, China, Russia and other associates in order to preclude a diminution of their war effort.

2. To provide the shipping required in order to sustain an all-out military effort, and concurrently, to provide for our commercial needs and to assist friendly Powers.

3. To equip and maintain forces for employment in Military Bases, Outlying Possessions, and Potential Task Forces as follows:

a. MILITARY BASES AND OUTLYING POSSESSIONS

Newfoundland	5,680
Greenland	2,631
Jamaica	876
Bermuda	3,741
Antigua	434
St. Lucia	434
Curacao - Aruba	5,961
British Guiana	352
Trinidad	28,411
Puerto Rico	34,757
Panama	42,614
Hawaii	61,337
Philippines	25,397
Alaska	28,823
Iceland	28,709
Scotland	10,147
Ireland	24,666
England	41,357
Total	346,217

b. POTENTIAL TASK FORCES

Brazil

1 Army Corps (Hq & Hq Co and Corps Troops)	17,147
1 Infantry Triangular Division	15,245
1 Air-Borne Division	10,000
2 Artillery Battalions (75mm How Pk)	1,804
1 Cavalry Regiment (R-M)	1,591
5 Parachute Battalions	2,580
1 Antiaircraft Regiment	1,926
2 Antiaircraft Battalions, 37mm (Mobile)	1,644
2 Aircraft Warning Regiments	2,600
2 Tank Battalions (Light)	1,088
3 Antitank Battalions (Gun)	2,100
Services (Med, Ord, QM, Engr, Sig)	28,864
Total	86,589

Colombia-Ecuador-Peru

1 Infantry Triangular Division	15,24[illegible]
2 Artillery Battalions (105mm)	1,40[illegible]
3 Parachute Battalions	1,68[illegible]
1 Antiaircraft Regiment	1,9[illegible]
2 Antiaircraft Battalions, 37mm (Mobile)	1,64[illegible]
2 Tank Battalions (Light)	1,08[illegible]
1 Aircraft Warning Regiment	1,3[illegible]
Services (Med, Ord, QM, Engr, Sig)	13,[illegible]
Total	37,2[illegible]

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FORCES

194

First Army

1 Army (Hq & Hq Co and Army Troops)	53,570
3 Army Corps Hq & Hq Co, and Corps Troops	51,441
9 Infantry Triangular Divisions	137,205
1 Armored Corps Hq and Corps Troops	2,768
4 Armored Divisions	50,788
4 Infantry Triangular Divisions (Mtzd)	64,516
4 Artillery Battalions (105mm)	4,200
1 Artillery Regiments (Heavy)	3,000
3 Artillery Battalions (75mm How Pk)	2,706
2 Mountain Divisions	24,000
2 Air-Borne Divisions	20,000
5 Parachute Battalions	2,590
20 Antiaircraft Regiments	38,500
10 Antiaircraft Battalions 37mm (Mobile)	8,470
3 Tank Battalions (Medium)	2,124
5 Tank Battalions (Light)	2,715
12 Aircraft Warning Regiments	15,600
10 Tank Destroyer Battalions	7,000
10 Antitank Battalions (Gun)	7,000
Services (Ord, QM, Sig, Engr, Med)	278,069
Total	776,262

Third Army

1 Army Hq & Hq Co and Army Troops	53,570
3 Army Corps Hq & Hq Co and Corps Troops	51,441
9 Infantry Triangular Divisions	137,205
1 Armored Corps Hq and Corps Troops	1,384
2 Armored Divisions	25,394
3 Infantry Triangular Divisions (Mtzd)	30,258
4 Artillery Battalions (105mm)	2,800
1 Artillery Regiment (Heavy)	1,500
1 Cavalry Corps Hq and Corps Troops	333
2 Cavalry Divisions	23,352
2 Cavalry Regiments (H-M)	3,182
2 Air-Borne Divisions	20,000
5 Parachute Battalions	2,590
5 Antiaircraft Regiments	9,625
3 Antiaircraft Battalions 37mm (Mobile)	2,541
3 Aircraft Warning Regiments	3,900
5 Tank Destroyer Battalions	3,500
10 Antitank Battalions (Gun)	7,000
Services (Med, Ord, QM, Engr, Sig)	207,840
Total	589,435

Fourth Army

1 Army Hq & Hq Co and Army Troops	53,570
3 Army Corps Hq & Hq Co and Corps Troops	51,441
9 Infantry Triangular Divisions	137,205
2 Armored Divisions	25,394
4 Infantry Triangular Divisions (Mtzd)	64,516
4 Artillery Battalions (105mm)	2,800
1 Artillery Regiments (Heavy)	6,000
2 Mountain Divisions	24,000
2 Air-Borne Divisions	20,000
2 Parachute Battalions	1,036
5 Antiaircraft Regiments	28,875
2 Antiaircraft Battalions 37mm (Mobile)	8,470
3 Tank Battalions (Medium)	2,124
5 Tank Battalions (Light)	2,715
5 Aircraft Warning Regiments	7,800
10 Tank Destroyer Battalions	7,000
5 Antitank Battalions (Gun)	10,500
Services (Med, Ord, QM, Engr, Sig)	266,413
Total	709,859

Total Potential Task Forces 2,199,441

c. The total number of troops considered necessary in the ground forces, i.e. organized, fully equipped and trained, for current and future employment as security forces in military bases and outlying possessions, and as striking forces in any theater, follow:

Bases and Outlying Possessions	346,217
Potential Task Forces	2,199,441
Total	2,545,658

5. Production capacity should be created to equip approximately 3 million additional men in the reserve pool indicated below. Activation, location, and training of these units will depend upon the international situation.

Strategic Reserves

2	Army Hq & Hq Cos. and Army Troops
10	Army Corps Hq & Hq Cos. and Corps Troops
27	Infantry Triangular Divisions
14	Armored Corps Hq & Hq Cos. and Corps Troops
53	Armored Divisions
51	Infantry Triangular Divisions (Mtzd)
24	Artillery Regiments (Heavy)
15	Artillery Battalions (75mm Pack)
52	Artillery Battalions (105mm)
2	Cavalry Divisions
6	Mountain Divisions
3	Air-Borne Divisions
22	Parachute Battalions
129	Antiaircraft Regiments
133	Antiaircraft Battalions, 37mm (Mobile)
70	Tank Battalions (Medium)
6	Tank Battalions (Light)
10	Tank Battalions (Heavy)
29	Aircraft Warning Regiments
290	Tank Destroyer Battalions
262	Antitank Battalions (Gun)
	Total (approximately) 3,000,000

6. The Army Aviation Program is included in a separate study, which indicates the detailed organization and requirements in essential equipment.

Total Air Force Personnel (Zone of Interior Troops excluded)	1,100,000

7. Zone of Interior and Fixed Defense Units

Army Ground Forces	1,200,000
Army Air Force	950,000
Total	2,150,000

8. Recapitulation

a. Army Ground Force

Military Bases and Outlying Possessions	346,217
Potential Task Forces	2,199,441
Zone of Interior and Fixed Defense (Ground)	1,200,000
Total Ground Forces (Activated)	3,745,658
Reserve Pool (activated as situation requires)	3,000,000
Total of all Ground Units	6,745,658

b. Army Air Force

Combat Units	1,100,000
Zone of Interior and Service Units	950,000
Total Air Force	2,050,000

c. Grand Total

Army Ground Units	6,745,658
Army Air Units	2,050,000
Total Army Forces	8,795,658

Tab A

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Note: British deficiency of the total force required. [illegible]

Enclosure 1 to Annex III.

FIRST LINE OPERATIONAL AIR REQUIREMENTS--JOINT LEVELS TO BE ATTAINED BY JULY 1, 1943.

AP. = Associated Power.

	Heavy Bomber	Medium Bomber	Light Bomber	S.E.Fighter	T.E. Fighter	G.R.Land Planes Medium Type.	Torpedo Bombers	Flying Boats	Transport Aircraft	Remarks
British Areas of Strategic Responsibility.										
United Kingdom and Iceland	BR.4,432(b) AP.1,844	BR.144	BR.440(a) AP.13	BR.1,744(a) AP.255	BR.668 AP.93	BR.56(b)	BR.128	BR.117 AP.96	BR.48 AP.32	(a) Includes Army reconnaissance aircraft.
Middle East	BR.80 AP.660	BR.240	BR.188(a)	BR.620(a) AP.480	BR.260 AP.150	BR.84	BR.42	...	BR.352 AP.96	(b) Heavy bomber total includes 200 aircraft for G.R. role.
West Africa	(c)	BR.32	BR.60	BR.92	...	BR.28	...	BR.12	...	(c) Facilities for operating 80 heavy bombers.
India	(d)	...	BR.104(a)	BR.168(a)	...	BR.28	...	...	BR. 16	(d) Facilities for operating 64 heavy bombers.
Far East	(e)	BR.128	BR.44(a)	BR.92	BR.124	BR.128	BR.28	BR.42	BR.32	(e) Facilities for operating 64 heavy bombers.
Dominions:--										
Australia	...	BR.128	BR.12	BR.12	BR.32	BR.168	...	BR.12	BR.20	Note:--Allotment to areas is not static and allows for strategic flexibility.
New Zealand	...	...	...	...	...	BR.56	...	BR.6	...	
South Africa	...	...	BR.44	BR.32	...	BR.60	...	...	BR.35	
Total: British Areas	8,016	672	905	3,475	1,327	606	198	335	631	
U.S.Areas of Strategic Responsibility.										
Western Hemisphere(a)	1,196	...	1,308	2,540	594	1,635	...	...	2,016	(a) Includes strategic reserves for defence and offence.
Philippine Isles	218	...	...	178	40	11.	...	...	...	Note:--O.T.U. airplanes not included U.S.or British figure. U.S.Naval air assignments in U.S.areas are also excluded.
Total: U.S.Areas	1,414	...	1,308	2,718	634	1,635	...	...	2,016	
Grand Total: Both Areas	8,430	672	2,213	6,193	1,961	2,241	198	333	2,647	

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Enclosure 2 to Annex III.

BRITISH AIRCRAFT REQUIREMENTS.

1. The figures given below give the totals of the numbers of aircraft in each class which it will be necessary to produce between the 1st October, 1941, and the 1st July, 1943, in order to build up the first line strength required in the British target programme.

The figures allow for wastage, but make no allowance for building up a reserve or for non-operational training aircraft.

Heavy Bombers	13,770
Medium Bombers...	6,610
Light Bombers	5,830
Single-Engine Fighters	16,230
Twin-Engine Fighters	4,380
Torpedo Bombers	785
Flying Boats	550
Transport aircraft	1,230
Total	49,385

2. The estimated totals of equipment, supplies and training potential required for the British target first line strength which cannot be met from British Empire resources will be made available to the British Delegation and Supply authorities in Washington.

UNITED STATES REQUIREMENTS IN AIRCRAFT UP TO JULY 1, 1943.

United States requirements are those set forth in Memorandum for Chief of Staff AAF-AS (AWPD) dated the 20th August, 1941, subject "Munitions Requirements of the Army Air Forces for the defeat of our potential enemies," reduced by ten (10) Medium Bombardment Groups and twelve (12) Pursuit Groups. The groups recommended for deletion were set up for offensive action against Germany. Deletion is recommended due to lack of aerodromes in the proposed operating areas.

Enclosure 3 to Annex III.

FORECAST OF U.K. AIRCRAFT PRODUCTION PROGRAMME (PROVISIONAL) WITHIN PERIOD OCTOBER 1, 1941, AND JULY 1, 1943.

Heavy Bombers	6,606
Medium Bombers	5,238
Light Bombers	1,981
Single Seater Fighters	13,438
Multi-Seater Fighters	3,905
Torpedo Bombers (Beaufort)	588
Flying Boats (Sunderland)...	297
Fleet Air Arm	3,779

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ANNEX IV.

Merchant Shipping.

Overall Requirements of the British Mercantile Marine in All Areas.

1. To meet the overall requirements of the British Mercantile Marine, production from British and United States yards is required to—

(a) replace the casualties in the British Mercantile Marine, which it is anticipated will be inflicted in the interval between now and January 1943; and
(b) provide the additional carrying capacity required to handle the increase in imports resulting from expansion in United States production.

2. The programme of merchant ship construction required to achieve this is outlined in the attached Enclosure. From this it will be seen that by January 1943, having allowed for the capacity of British yards, a total of about 5 million gross tons of shipping is required from the United States to supplement British tonnage. This figure is in addition to the tonnage which is already being built to British orders in the United States. Owing to the present steady fall in import capacity caused by the casualties inflicted on British shipping, it is most desirable that as much of this shipping as possible is provided before this date. The sooner the tonnage is made available to the United Kingdom, the greater is the relief that it affords.

3. The proposed combined United States and British mercantile building programme for British use after January 1943, as set out in the Enclosure, is calculated:—

(a) to maintain the position;
(b) to replace casualties;
(c) to replace worn-out tonnage.

We estimate that it will also create a reserve of shipping which should be available to support further military operations.

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Enclosure to Annex IV.
Merchant Shipping.
Units--Thousands of Gross Tons.

1 Category	2 Total British Requirements.	3 Losses to Date	4 Annual Rate of Loss and Replacement, excluding Superannuation.	5 Losses from all Causes by Jan. 1943.	6 Total required by Jan. 1943. 2 + 5	7 Now in Service June 1941.	8 British Building by Jan. 1943.	9 Annual Rate of British Building.	10 Total by Jan. 1943 by British effort. 7 + 8	11 Desired from U.S.A. by Jan. 1943. 6 - 10	12 Desired subsequently at Annual Rate of.
Non-Tanker tonnage	17,500	Not Included	3,600	4,500	22,000	15,810	1,400	1,100	17,210	4,790	3,750
Tanker tonnage	4,560	Not Included	900	1,125	5,625	4,200	747	500	4,947	678	500

Note (i).--A target figure of imports into the United Kingdom of 34 million tons a year (excluding oil) has been aimed for. The total in column 2 is sufficient to provide this rate and to support British military operations on the present scale.

Note (ii).--The total requirements from the United States by January 1943 (vide column 11) are 4,790,000 tons of non-tanker and 678,000 tons of tanker tonnage. A total of 414,000 tons is already building in the United States to British account. An additional 5,054,000 tons of shipping (tankers included) is therefore required from the United States, to be provided from the following sources:--

(a) New construction on lease-lend account.
(b) Transfers of existing tonnage.
(c) Employment of United States flag ships in the N. Atlantic.

Provision must also be made for the maintenance of this additional tonnage.

Note (iii).--Assuming the requirement in column 11 has been delivered, it is proposed that the building programme after January 1943 should continue at the following rates:--

United States--
Non-tanker: 3,750,000 tons/year.
Tanker: 500,000 tons/year.

United Kingdom--
Non-tanker: 1,100,000 tons/year.
Tanker: 500,000 tons/year.

This allows for--

(a) replacement of casualties at an annual rate of 4½ million tons a year.
(b) replacement of superannuated tonnage at an overall rate of 7 per cent per annum.

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ANNEX V.

Priorities.

1. We give below a general expression of our views on the priorities which should be allotted in--

(a) the production of aircraft.
(b) the production of merchant shipping and certain Naval vessels.

Production of Aircraft.

2. First, maintain the necessary level of fighter aircraft in the British Isles and the Middle East for security purposes.

Second, heavy bombers and flying boats.

Third, proportionate production of all other types.

Shipbuilding.

3. Translated into tonnage, the priority of the various requirements is considered to be as follows:--

	Tonnage in thousands		Delivery Commencing. (to be delivered by Jan. 1943.)
1.--(a) Merchant shipping	5,468	G.R.T.	
(b) Seagoing Tugs	30	Standard Displacement.	July 1942.
(c) Salvage Vessels	13	"	Jan. 1942.
2. Escort Vessels (ocean-going) ...	435	"	Jan. 1943.
3. Destroyers	99	"	July 1943.
4. Aux. Aircraft Carriers	256	"	Jan. 1942.
5. Aircraft Carrier	100	"	Jan. 1945.
6. Submarines	32	"	Jan. 1943.
7. Minesweepers	235	"	Jan. 1942.
8. Cruisers	140	"	Jan. 1944.
9. Remainder of Naval Coastal Frontier Forces	42	"	Jan. 1942.
10. Depot and Repair Ships	24	"	Jan. 1943.

These figures include those ships on order to British account in the United States and those already allocated to the British under Lease-Lend.

4. We cannot foresee the effect of the increase in the number of convoy escort vessels on the rate of losses of merchant ships. As the situation develops, therefore, the priorities must be the subject of continuous review.

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TABLE II

Notes on Deficiencies in British Supplies

	Deficiency	Notes
Cruiser and Light Tanks	11,500	M.3 Tanks assembled by Montreal Loco are included in Empire output and cannot be counted against this deficiency.
Light Reconnaissance Cars	400	Can probably be made good from Empire production.
Field Guns	500	Can probably be made good from Empire production.
Medium Artillery	900	155 mm. Howe. acceptable to meet this deficiency.
Heavy Artillery	140	
Anti-Tank Equipment	6,000	This requirement is for guns of the 6pdr. or heavier class.
A.A. Light	1,700	Our requisition for 2,500 guns was put forward to cover deficiency in 1942.
A.A. Heavy	3,200	
Rifles	1,650,000	This deficiency is covered in part by sub machine gun orders and most of the balance by output of plant already in production in U.S.A. It is hoped that their output can be expedited.
Light Infantry machine guns (Bren)	40,000	No request is being made for production of light infantry machine guns in U.S.A. But, if .30 Brownings cannot be provided to make good the shortage of medium Besas for British built tanks, the deficiency of light machine guns will be increased by the necessity of turning over Bren capacity in the Empire to make Besas.
Anti-Tank Rifles	9,000	Can possibly be made good from Empire, particularly Canada, with machine tool priority.
Tank Weapons for U.S. built tanks	Depends upon tank output.	
Machine guns for British type Tanks	11,000	See note on light infantry machine guns.
Wheeled Vehicles		
Motor Cycles (Solo and Combination)	100,000	30,000 of this deficit can be made by Blitz Buggies not yet requisitioned. A

(Notes continued on next page)

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	Deficiency	Notes
Wheeled Vehicles (contd.)		
		limited number of American motor bicycles would be acceptable.
Trucks, Lorries and Light Tractors	50,000	A proportion of this may be asked from U.S.A.
Transporters and Recovery Vehicles.	7,700	This deficiency of Heavy Tank Transporters and Recovery Vehicles can only be made good from U.S.A.
6-ton and 10-ton Lorries	4,250	Most of this deficiency will have to be made good in U.S.A. The exact types of the balance required is not yet determined.

AMMUNITION

A survey of production possibilities in the Empire shows that in general terms we shall only need to ask the U.S.A. to provide ammunition to equip the guns to be produced in the U.S.A.

Since armament of the Tanks is still uncertain, these requirements can best be indicated in terms of the number of rounds per gun required,

Medium	155 mm. How.	3,000 r.p.g.
Heavy	155 mm. Gun	2,000 r.p.g.
	8" How.	3,000 r.p.g.
A.A. Light & Heavy		2,000 r.p.g.
Tank or Anti-Tank	37 mm. and 6 pr.) 75 mm. Tank)	800 r.p.g.

.30 Ammunition

For .30 rifles and ground machine guns	750 m.
For machine guns in Aircraft and ships	350 m.
For Machine guns in U.S. and Canadian M.3 Tanks at 50,000 rounds per tank say	525 m.
For .30 machine guns in British built tanks at 25,000 rounds per gun	275 m.
	2,000 m.

These are required in the following proportions:-

A.P.	400 m.
Tracer	300 m.
Ball	1,150 m.
Indendiary	150 m.
	2,000 m.

Thompson sub-machine guns (.45")

We rely entirely upon U.S.A. 2,000 rounds are required for each gun to cover expenditure until mid 1943. This gives a total of 1,000 million rounds for the 500,000 guns received or on requisition. Of this some 150 million rounds have already been received on British orders.

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Minutes of the Committee Meeting on the Victory Program.

Present at the Meeting - General Embick, General Ismay, General Burns, Sir Wilfred Freeman, Admiral Ghormley, Brigadier Dykes, General MacCready, Admiral Standley.

General Embick presided and opened the meeting with general remarks as to the purpose to be accomplished.

Brigadier Dykes stated that the basis of the United Kingdom proposals was on proposed action in areas of strategical responsibility assigned the United Kingdom in ABC one, and the list of equipment (major items only) required therein. Developed from the ABC plan the figures contained were not to be considered as essential but merely as a basis of discussion in connection with the forces contemplated for attack.

United Kingdom naval representative stated that the shipping situation must be considered, as forces must be brought within the limits of transport.

Colonel Bundy presented the basis upon which the United States proposals had been prepared, said that shipping had been considered but that the forces were not limited unduly by shipping as the war must be won by the forces necessary therefor and shipping must be brought into consonance with troop requirements even though a tremendous shipping effort was involved. He further added that the American delegation desired to take back to the United States all possible information on the principal items.

Brigadier Dykes: "Did the United States consider what forces the United Kingdom would have in the Middle East for example?"

Colonel Bundy: "No. The plan was based on the necessary troops to accomplish victory and a general estimate was founded on enemy forces without consideration of individual theatres or commanding of such theatres."

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Admiral Standley stated that the matter in many respects resolved itself into one of production.

General Ismay agreed with Admiral Standley but stated that he considered a strategical agreement between the representatives of the United Kingdom and the representatives of the United States to be a necessity.

There followed some general discussion.

A Sub-Committee was then appointed to study the subject from a strategical point of view and report back to the full committee.

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VICTORY PROGRAMME.

BRITISH REQUIREMENTS AND PRODUCTION.

1. The tables of Britain's overall requirements and production submitted at the recent Anglo-American Conference, the present statements and the conclusions drawn from them as to the supplies which we need to draw from the United States, should be regarded as provisional. They are submitted as a general guide to one of the elements which will be taken into account in deciding the scale of America's armament production.

2. The calls on the output of the United States include,

(a) her own requirements,
(b) the needs of China, Russia and other countries which may join in resistance to Nazi Germany,
(c) the deficiency in supplies for the forces in the British area of responsibility composed of British manpower,
(d) equipment for forces required in that area for which British manpower is not available.

The present statement deals only with (c).

3. The requirements of our armed forces-on whose expansion the supply of manpower imposes an effective limit - do not rise indefinitely. A calculation extending over a period of nearly two years reveals that at the end of that time, if there were no other drain on our resources, these requirements would be very largely met from British Empire production and that, by June 1943, relatively little would be needed from the United States.

On the other hand, in 1942 and the opening months of 1943 the deficit is substantial. If the U.S. is to make an important contribution towards the arming of the British Empire land forces, it should become available within the next 18 months.

4. In the tables previously put forward, the forecasts of production related to factory output up to the end of June 1943. In actual fact, there is a considerable time lag between factory production and the date when armaments are effectively in the hands of formed units. This is due to final inspection, transit (which for a proportion of our supplies means sea as well as land transportation) and the matching with complementary arms, spares etc. It is not unreasonable to assume that the requirements indicated to the end of June 1943 should be produced by the end of March 1943.

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Moreover, the forecasts of production previously given make no provision for losses in ocean transit or losses of British production due to enemy action. 10% is a moderate discount to allow for these risks. Allowance has been made for this discount and for the time lag referred to in drawing up the following tables.

5. The requirements for Anti-Tank equipments originally set out in the paper on Victory Requirements (B.H.(41)14) contained some duplication owing to the changeover during 1942 from the British 2 pr. to the 6 pr. We do not ask at this stage for any additional supply of any light Anti-Tank weapon, but only for help in meeting our requirement for 6 prs. 17 prs. or equivalent weapons of American type. The figures, therefore, refer only to our 6 pr. and 17 pr. requirements.

6. After making the adjustments described in paragraphs 4 and 5, the quantities needed up to the middle of 1943 for the equipment of units for which British manpower is available and the supplies available from British sources, are as shown below in Table I.

7. The deficiencies resulting from the figures together with brief comments, are listed in Table II. A fuller statement of our proposals in regard to each item is in preparation.

8. The requirements in Table I do not include any allowance for supplies of British material that may be sent to Russia. To the extent that British Empire supplies are so employed, the deficiencies shown in Table II in the provisioning of our own forces will be correspondingly increased.

9. No reference is made in this paper to Programme B. That programme was designed completely to equip a supplementary force - which might be manned by possible Allies - with American type weapons. It is therefore, a balanced whole; and even where the types are suitable, the quantities are not in the proportions needed to fill the deficiencies in Table II.

It appears improbable, however, that a balanced equipment for an Allied force will have to be met on any considerable scale before 1943. In certain cases therefore where our immediate shortage of equipment is dangerously large, we should be glad to draw on Programme B as an interim measure on the understanding that we replace the weapons so drawn (or their equivalent) as and when an Allied need arises for it in 1943, - by which time our own production will have reduced our shortage. In this way the integrity of Programme B will be preserved in respect of major items of equipment.

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CONDENSED REPORT OF PROPOSED FUTURE GROUND, NAVAL AND AIR STRENGTHS OF GREAT BRITAIN AND UNITED STATES

GROUND FORCES BY JUNE 30, 1943:

	BRITAIN	UNITED STATES
Army Hq & Hq Cos.		5
Army Troops		5
Corps Hq & Hq Cos.	18	20
Corps Troops		20
Armored Corps Hq & Hq Cos.		17
Armored Corps Troops		17
Infantry Triangular Divisions	59	61
Infantry Triangular Divisions (MT20)		41
Infantry Provisional Division		1
Infantry Brigades	8	
Independent Infantry Brigade Groups	26	
Armored Divisions	24	41
Armored Regiments	2	
Cavalry Divisions	2	4
Mountain Divisions		10
Air Borne Divisions		10
Air Borne Battalion		1
Infantry Regiments		9
Infantry Battalion	185	1
Training Garrison Battalions	123,800 men	
Artillery Regiments (Heavy)		34
Artillery Battalions (75 mm. How PK)		21
Artillery Battalions (105 mm)		72
Battalion Artillery Corps		1
Battery (75 mm How)		1
Cavalry Corps Hq & Hq Troop		1
Cavalry Corps Troops		1
Cavalry Regiments (H-M)		3
Cavalry Regiments (Horse)		1
Antiaircraft Regiments		95
Antiaircraft Battalions 37 mm (Mobile)		68
Antiaircraft Batteries		4
Antiaircraft Guns (Heavy)	8,342	
Antiaircraft Guns (Light)	12,760	
Aircraft Warning Regiments		58
Aircraft Warning Companies		2
Parachute Battalions		48
Army Tank Brigades	13	
Tank Battalions (Light)		24
Tank Battalions (Medium)		76

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	BRITAIN	UNITED STATES
Tank Battalions (Heavy)		10
Tank Company (Light)		1
Anti-tank Battalions		200
Tank Destroyer Battalions		216
Harbor Defense Regiments		2
Harbor Defense Battalions		2
Harbor Defense (Hawaii) Personnel		3220
Harbor Defense (Philippines) Personnel		4500
Smaller Bases (Incl. Services) Personnel		32144

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NAVAL

JANUARY 1947

	BRITAIN		UNITED STATES		
	Available	Short	Available	Short	Total
Battleships	23	-	32	-	55
Aircraft Carriers	15	4	18	6	33
Aux. Aircraft Carriers	1	16	-	-	1
8" Cruisers (Heavy)	18	5	6	4	24
6" Cruisers (Heavy)	51	-	26	0	77
Cruisers (Light)	34	11	59	16	93
	JANUARY 1944				
Destroyers	353	55	364	80	717
Submarines	157	40	184	54	341
Depot & Repair Ships	27	2			27
Escort	305	410			305
Naval Coastal Frontier Forces	2950	410	729	600	3679
Auxiliaries, large			278	100	278
Utility Craft (Naval District)			593	500	593
Tank Landing Craft (Small)	1300				
Tank Landing Ships (Ocean Going)	13				

In addition to above, the following is provided by January 1947:

a. 300,000 tons of Naval Combatant Vessels for the British Commonwealth.

b. 200,000 tons of Naval Combatant Vessels for Latin-American Countries.

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TYPES OF AIRCRAFT	BRITAIN	M.R. in AFS.	U. S.	M.R. in AFS	TOTAL	TOTAL M.R.
Medium Bombers	6,610	?	1,062	286	7,672	?
Heavy Bombers 17&24	)	?	3,995	547	)	
" " 29&32	) 13,770	?	2,040	546	) 23,545	?
Heavy Bombers 4000 Mi R/A	)	?	3,740	501	)	
Light Bombers	)	?	946	42	6,776	?
Dive Bombers	) 5,830	?	1,255	56	1,255	?
Inter. - Day	16,230	?	7,088	465	23,318	?
Inter. - Night	4,380	?	1,687	111	6,067	?
Observation			1,901	98	1,901	?
Photo			142	23	142	?
Transport	1,230	?	1,040	25	2,270	?
Training			1,520	77	1,520	?
Torpedo Bombers	785	?			785	?
Flying Boats	550	?			550	?
TOTAL	49,385		26,416			
			GRAND TOTAL		75,801	

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S E C R E T.

B. M. (41) 2.

14th September, 1941.

CONFERENCE ON BRITISH-UNITED STATES PRODUCTION.

OVERALL PRODUCTION REQUIREMENTS FOR VICTORY.

Note by the British Representatives.

On the basis of the General Strategy Paper,*, we have prepared provisional estimates of the military requirements in British areas of responsibility. We attach these estimates in Appendices as follows:-

Appendices A and B - Navy.
Appendix C - Army.
" D - Air Force.

The tables at the end of each Appendix show what these requirements mean when translated into terms of production.

2. We put forward these estimates as a basis of discussion, in much the same way that a prospective house-builder might present his architect with a first sketch of the house he would like him to build. As he might draw up a plan showing what he would like, so we have drawn up these estimates showing what forces we think, from the purely strategic point of view, it should be the aim to create in British areas of responsibility. We may find on examination that these requirements must be modified in the light of the many considerations which will arise in tackling a problem of this dimension. The time factor alone may force some modification if we are to develop our full strength by the Spring of 1943.

3. We suggest, therefore, that as a first step we should discuss the estimates in the attached Appendices against the background of the General Strategy Paper. Once the general nature and scope of the forces to be created have been agreed, we can proceed to relate the requirements to the realities of production.

4. There is one overriding factor which must be carefully considered. The losses of shipping under British control during the third year of war are estimated at about 4 3/4 million gross tons. This takes no account of possible losses of American controlled tonnage serving in the Allied interest, which losses should be reckoned at about 3/4 million gross tons, making a total of 5 1/2 million gross tons. Against this, new construction in British Empire ports is estimated at just over one million gross tons a year. Replacement for

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the balance of 4½ million tons must be sought elsewhere. If in addition the vastly increased resources contemplated in the attached estimates are to be brought into action by the Spring of 1943, some increase in the shipbuilding programmes is inevitable. The building of ships must keep pace with the production of equipment and the expansion of the armed forces.

(Signed) A.T. CORNWALL-JONES.

Secretary
on behalf of the British
Representatives.

Great George Street, S.W.1
14th September, 1941.

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APPENDIX "A

NAVAL REQUIREMENTS IN BRITISH A

SHIPS	U.K. & British Home Waters. (1)	North Atlantic (2)	South Atlantic (3)	Mediterranean (4)
Capital Ships	3	3ø		4
Aircraft Carriers	2	1ø	1	2
Aux. Aircraft Carriers	6		4	
Cruisers Heavy	3	4ø	5	1
" Medium)	15		5)	7
Light)			2)	
A.M.Cs & O.B.Vs.	15		12	
A.A. Ships	3			2
Auxiliary A.A. Ships	5			
Destroyers (i) Fleet	41	20x		36
" (ii)L.R.& Escort	150	≠	≠	
Sloops and Cutters L.D. & Escort		≠	2≠	2
Corvettes. L.D. & Escort	10	≠	-≠	12
Ocean-going convoy Escorts	----------	----------	----------	In areas o
I. Minesweepers.(Fleet)	112	8		24
II. " (Moored)	500	8	24	16
III. " (Magnetic)	500	6	18	56
A/S Trawlers & local craft.	218	30	20	40
A/S M.Ls.	354	20	36	46
M.T.B.,M.G.B., & S.G.B.	219			40
Minelayers (large)	5			
" (fast)	4			2
" (coastal)	4			
Submarines	59	17ø		36
Depot & Repair Ships	11		4	5
Boom & Gate Vessels				
Special Assault Ships.	23			10
Tank Landing Craft	1,200			100
Motor " "	400			100
Assault " "	400			100
Support " "	50			20
Raiding Craft.	150			50
Eagle Ships.	30			6

Note. Existing British naval above figures.

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AREAS OF RESPONSIBILITY.

India and East Indies Station (5)	Far East (6)	Australia & New Zealand (7)	Strategic Reserve (8)	Total British Areas. (9)	REMARKS (10)
	7		4	21	Note ϕ U.S. Navy.
	2		3	11	
2				12	
1	4			17	
1	11		)9	58	
4	4		)		
6	3			36	
1				6	
				5	
	32			129	* 13 U.S. Destroyers.
	13			163	)Note: ≠Local defence and)escort is provided by the)forces allocated for the
8≠	≠			12	)purpose or by ocean escort)vessels in port. The numbers
12=	12≠	12≠		58	)indicated are those forces)permanently based at ports)for local operations.
f responsibility----------				620	))
18	40	32		234	
46	32	50		676	
56	44	18		698	
10	35	45		398	
40	72	80		648	
	32			291	
				5	
				6	
1		1		6	
	22			134	42 to be long-range type.
1	4		2	27	
				240	Not possible to allocate.
				33	
				1,300	
				500	
				500	
				70	
				200	
12	6			54	

forces are included in the

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TABLE "A".

NAVAL REQUIREMENTS.

I. The figures below give the approximate number of ships, vessels and craft it will be necessary to produce during the period 30th June, 1941 to 31st March, 1943 in order to meet the requirements set out in Appendix "A" above.

Capital Ships	3
Aircraft Carriers	2
Cruisers	13
Auxiliary Aircraft Carriers	11
Fleet Destroyers	70
Sloops, A.A. Destroyers, Corvettes, for convoy escort.	550
Minesweepers (Fleet)	270
Minesweepers (for moored mines)	360
Minesweepers (for Magnetic mines)	480
A/S Trawlers and Local Craft	230
A/S M.Ls	540
M.T.Bs, M.G.Bs etc.	320
Submarines	80
Depot and Repair Ships	7
Boom and Gate Vessels	67
Tank Landing Craft	1,500
Motor Landing Craft	480
Assualt Landing Craft	490
Support Landing Craft	65
Eagle Ships	40
Special Assault Ships	20

II. The figures below give the approximate requirements in equipment which will have to be produced during the period 30th June, 1941 to 31st March 1943, assuming that the ships vessels and craft in I. above can be provided.

Guns.

Anti-Aircraft over 20 m.m.	16,400
Oerlikon	28,000
Naval Machine Guns	15,500
Other than A.A. on transferable Mtgs.	850

Ammunition

Small arms including 20 m.m. (millions of rounds)	770
A.A. Long range 3" and above (thousands of rounds)	6,700
A.A. Short range (2 pdr. to 3")(thousands of rounds)	39,500
Other than A.A. over 20 m.m. (thousands of rounds)	1,840

Torpedoes.

For use from Ships and S/Ms.	8,400

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PRODUCTION OF SUPPLY AIRCRAFT FOR 1943

December 21, 1942

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THE JOINT CHIEFS OF STAFF

JOINT U. S. STRATEGIC COMMITTEE

WASHINGTON

December 24, 1942.

MEMORANDUM FOR GENERAL ANDERSON:

Subject: JPS 69/3 - Proposed 1943 Aircraft Allocations.

1. Forwarded herewith are ten (10) copies of each of the Tabs to the subject report.

Tab A - Summary of Proposed 1943 Aircraft Allocations. (1 page).

Tab B - Summary of Proposed 1943 Aircraft Allocations under Defense Aid. (3 pages).

Tab C - Detail of Proposed 1943 Aircraft Allocations under Defense Aid. (10 pages).

Tab D - Summary of Proposed 1943 Aircraft Allocations to U.S. Navy. (2 pages).

Tab E - Summary of Proposed 1943 Aircraft Allocations to U.S. Army. (2 pages).

Tab F - Summary of Proposed 1943 Aircraft Allocations from U.S. Army Production Cognizance for U.S. Navy use and from U.S. Navy Production Cognizance for U.S. Army use. (1 page).

Tab G - Monthly schedule of U.S. Financed Aircraft Production for 1943. (5 pages).

2. The above Tabs have been forwarded at the request of General Partridge. They are advance copies furnished for planning purposes. The study has not yet been approved by the Joint Staff Planners.

C.F. BARBER,
Secretary.

FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

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Class		Combat Service	Dec. 1943 Operative Aircraft																		Dec. 1943 Projection	
Heavy Bombers 4-E	B-17,24,29,30,31	Army	11,184	558																		
Patrol Bomber 4-E	PB2Y-3	Navy	178	100																		
Patrol Bomber 2-E	PBM,PBY,PB4Y,P4Y	Navy	1,151	107																		
Medium Bomber 2-E	B-26,26,34	Army	1,642	274	107	21	14	102		54												
Light Bomber 2-E	A-20,29,30	Army	1,750	498				1,040														
Light Bomber 1-E (Dive)	A-24,25,31,35,36	Army	1,582	791				1,041														
Light Bomber 1-E (Dive)	SBD,SB2D,SB2C,SB2A	Navy	4,140	276	184			1,104														
Light Bomber 1-E (Torp)	TBF,TBM,TBD	Navy	3,447	345				1,035														
Fighters 2-E	P-38,61	Army	1,589																			
Fighters 1-E (Land)	P-39,40,47,51	Army	20,235	1,295						195	19	45										
Fighters 1-E (Carrier)	F4F,F6F,F8F2T,F3A	Navy	9,144		914																	
Scout Obs. 1-E	SOC, SOR	Navy	1,772																			
TOTAL COMBAT			74,759	4,419	1,205	242	238	4,322	77	433	73	19	45									
Heavy Transport 4-E	C-54,69,87	Army	384																			
Heavy T (Boat) 4-E	PBGT-3B (Included with combat)		(154)																			
Heavy T (Boat) 2-E	PBM-5 " " "		(140)																			
Heavy Transport 2-E	C-46,82	Army	823																			
Medium Transport 2-E	C-47,53,49,76	Army	4,312	431	35			431														
Medium Transport 2-E	R4D-1	Navy	1,005																			
Light Transport 2-E	C-60	Army	60		42						15	31										
Light Trans. 1 & 2-E	C-61,64,78,43	Army	1,314	131				394														
Light T(Amphib)1A2-E	JRF,J2F,OSF	Navy	1,176		34																	
Light Transport 1-E	GP-1	Navy	536																			
TOTAL SERVICE COMBAT			9,810	565	76	22	20	825	7	43	7	4	9	31								
TOTAL TACTICAL	Army Cognizance		(59,854)																			
	Navy Cognizance		(22,443)																			
TOTAL TACTICAL			84,297	4,984	1,281	264	258	5,147	84	476	80	23	54	31								
Adv.Trainers 2-E (Bomb)	AT-11,13,14,15	Army	1,236																			
Adv.Trainers 2-E (Nav.)	AT-7	Army	408																			
Adv.Trainers 2-E (Trans)	AT-9,10,17	Army	1,803																			
Adv.Trainers 1-E	AT-6,16,19	Army	1,923	1,827	1,080						18	170	1,995									
Basic Trainers 1-E	PT-17,13,15	Army	5,345										300									
Primary Trainers 1-E	PT,17,19,13,25,26	Army	5,930	593	296						74	222	1,187									
Primary Trainers 1-E	NPT-1,BM-1	Navy	624											249								
TOTAL TRAINERS	Army Cognizance		(24,444)																			
	Navy Cognizance		(624)																			
TOTAL TRAINERS			25,068	2,420	1,376						92	392	3,482	249								

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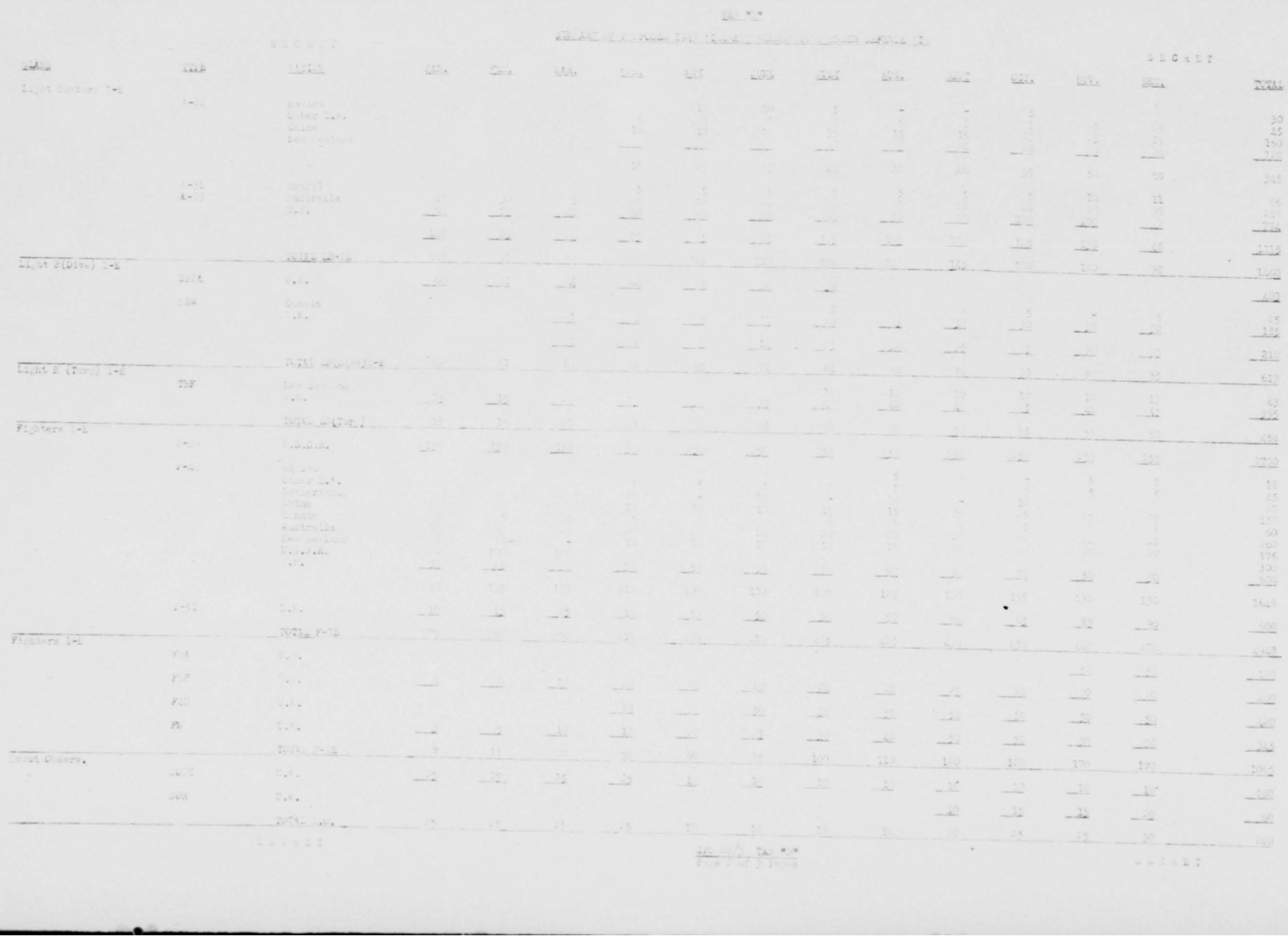

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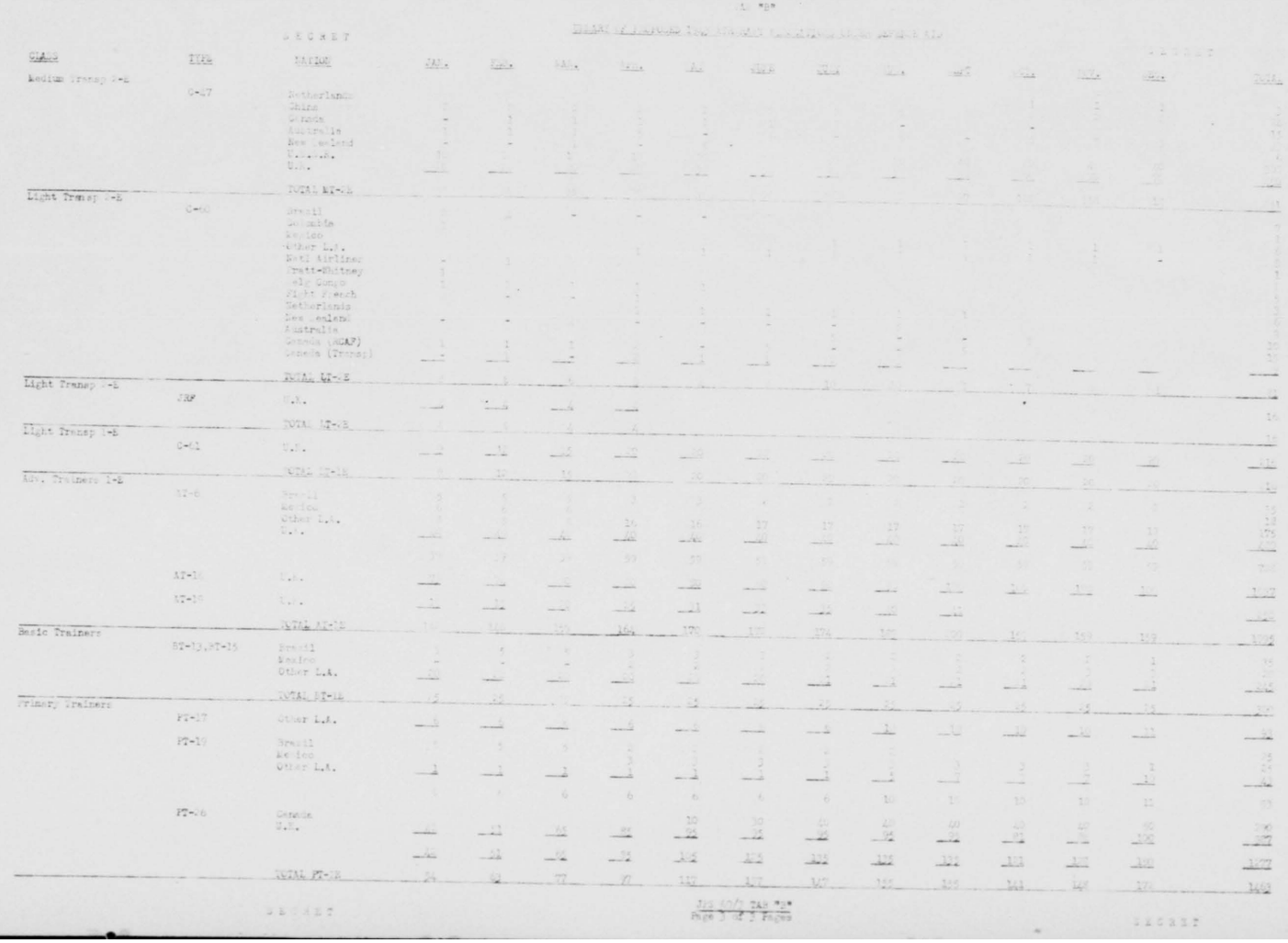

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UNITED KINGDOM - ROYAL AIR FORCE

	Recommended for 1943			U.K. Planned Production Only/Proposed Delivery Target - 1942												
	Add U.K. attr.	Total	Type	Type Acft.	J	F	M	A	M	J	J	A	S	O	N	D	Total
Heavy Bombers 4-E		398	B-24	Army	15	20	25	35	40	45	47	43	28				298
Patrol Bomber 4-E		100	PBZY-3	Navy	-	-	4	6	10	10	10	10	10	10	10	10	100
Patrol Bomber 2-E		60	PBY-5(?)	Navy	10	10	10	10	10	10							60
		177	PBY (Can)	Navy	-	-	7	10	20	20	20	20	20	20	20	20	177
		100	PBN	Navy	-	-	4	6	7	10	12	12	12	12	12	12	100
Medium Bomber 2-E		200	B-25	Army	-	-	-	20	20	20	20	20	25	25	25	25	200
		276	B-26	Army	-	-	-	25	25	25	30	30	35	35	35	35	275
Light Bombers 2-E		100	A-20	Army	10	9	-	6	10	10	10	10	10	10	10	5	100
		83	A-29	Army	-	53	30	-									83
		705	A-30	Army	50	55	60	60	60	60	60	60	60	60	56	60	705
Light Bombers 1-E		796	A-31,35	Army	67	55	45	50	70	80	80	80	100	100	70		796
		403	SBD	Navy	40	43	42	40	40	40	38	-	-	-	-	-	403
Fighters 2-E																	
Fighters 1-E		600	P-40	Army	55	45	50	55	50	50	50	50	50	50	50	50	600
		600	P-51	Army	10	35	25	50	50	50	50	50	50	44	44	42	500
Scout Observ.																	
TOTAL COMBAT		4596			277	323	326	397	421	430	425	389	479	419	436	361	4584
(To U.S.S.R. - on U.K. acct)		1500	P-39	Army	Tabulated with U.S.A.A.F.												1500
(To U.S.S.R. - on U.K. acct)		300	P-40	Army	Tabulated with U.S.A.A.F.												300
Heavy Transp 4-E																	
Medium Trans 2-E		450	C-47	Army	20	20	20	20	30	30	30	30	50	60	90	90	450
Light Transp 2-E (Amph)																	
Light Transp 1-E		214	C-61	Army	9	12	15	20	25	20	25	20	20	25	30	30	214
TOTAL SERVICE COMBAT		664			29	32	35	40	55	50	55	50	70	85	120	120	664
TOTAL TACTICAL		5262			306	355	361	437	476	480	480	439	549	504	556	481	5248
(To U.S.S.R. - on U.K. acct)		1800			Tabulated with U.S.A.A.F.												1800
Adv. Trainer 1-E		480	AT-6(Can)	Army	40	40	40	40	40	40	40	40	40	40	40	40	480
		1037	AT-16(Tex)	Army	73	74	80	80	80	80	80	80	100	100	100	100	1029
Primary Trainer 1-E		336	PT-26(US)	Army	35	35	35	35	35	35	35	34	21	-	-	-	336
		451	PT-26(Can)	Army	7	14	30	50	40	40	60	60	60	60	60	60	501
TOTAL TRAINERS		2304			155	163	185	205	215	215	215	214	221	200	200	200	2346
GRAND TOTAL ALL TYPES		7566			461	520	546	642	691	695	695	653	770	704	756	681	7594
(To U.S.S.R. - on U.K. acct)		1800			Tabulated with U.S.A.A.F.												1800

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TAB "C"

DETAIL OF PROPOSED 1943 AIRCRAFT ALLOCATIONS UNDER JUSTICE 47b
CANADA - MAF

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	12-31-42 Latiented Status					12-31-43 Desired Status			12-31-43 Recommended Status						Recommended for 1943					U.S. Financed Production Only Proposed Delivery Target - 1943												
	No.of Sqds.	Airpl per Sqd	Reqd U.S.	Airpl or Hand or Enroute	Type	No.of Sqds.	Airpl per Sqd	Reqd U.S.	No.of Sqds.	Airpl per Sqd	Reqd U.S.	Type	Add U.S. Reqs.	Source	Add U.S.	Attr	Total	Type	Cogn Serv.	J	F	M	A	M	J	J	A	S	O	N	D	Total
Heavy Bombers 4-E																																
Patrol Bomber 4-E																																
Patrol Bomber 2-E	10	15	150	110	(58 Canso (30 Stran (13 Shark (9 Digby	13	15	195	7	15	105	PBY	47	Canada		(Canadian Financed)																
Medium Bomber 2-E						9	15	135	7	15	105	B-34	48	U.S.	48	109	157	B-34	Army	-	25	25	25	12	10	10	10	10	10	10	10	157
Light Bomber 2-E	8	15	120	57*	Hudson	1	15	15	1	15	15	Boeqa	15	Canada	-	(Canadian Financed)																
Light Bomber 1-E						2	15	30	1	15	15	A34	15	Can.(Us)	15	10	25	A34	Navy	-	-	-	-	-	2	3	5	5	5	-	5	25
Fighters 2-E	½(14 1) 16		66	0		(4(16 1) (2	15 15	64 30	4(16 1) 0	16	64 0	Boeqa	64 0	Canada		(Canadian Financed)																
Fighters 1-E	14	15	210	238	(140 Hurr (98 P-40	14	15	210	8	15	120	(Hurr (P-40	90 0	Canada U.S.	0	(Canadian Financed) 60	60	P-40	Army	5	5	5	5	5	5	5	5	5	5	5	5	60
Scout Obs. (Army Coop)	1	15	15	15	Lysander	2	16	32	1	16	16	Boeqa	16	Canada		(Canadian Financed)																
(Coast Art Coop)	1	18	18	26	Lysander	1	18	18	1	18	18	Lysan	0	U.K.																		
TOTAL COMBAT	37½		649	446		48		729	30		458		296		63	179	342			5	30	30	30	17	17	18	20	20	20	15	20	242
Heavy Transp 4-E						2	15	30	0		0		0																			
Medium Trans 2-E						½	18	9	1	13	13	C-47	13	U.S.	13	2	15	C-47	Army	-	1	1	1	1	1	5	-	5	-	-	-	15
Light Transp 2-E						½	12	6	1	13	13	C-60	13	U.S.	13	2	15	C-60	Army	1	1	1	2	-	5	-	-	5	-	-	-	15
Light Transp 1-E															0**	0	0**	C-60	Army	-	1	-	2.	1	1	2	2						9**
TOTAL SERVICE COMBAT						5		45	2		26		26		26	4	30			1	3	2	5	2	7	7	2	10	-	-	-	39
TOTAL TACTICAL						53		774	32		484		321		98	183	281			6	33	32	35	19	24	25	22	30	20	15	20	281
Primary Trainers 1-E															290***	0	290	PT-26(Can)	Army***	-	-	-	-	10	30	40	40	40	40	40	50	290***
TOTAL ALL TRAINERS						-		-	-		-		-		-	-	-			-	-	-	-	-	-	-	-	-	-	-	-	-
															290	0	290			-	-	-	-	10	30	40	40	40	40	40	50	290***
GRAND TOTAL ALL TYPES						53		774	32		484		321		388	183	571			6	33	32	35	29	54	65	62	70	60	55	70	571

* Plus 46 Bolingbrokes on loan from the Combined Training Organization.

** For Department of Transportation.
*** In return for 290 PT-17's turned back to U.S. A.A.F. in 1942.

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TAB "C"

DETAILS OF BRITISH (INCL. DOMINION) ALLOCATIONS TO U.S. FURNISH AIR

AUSTRALIA - Deaf

	12-31-42 Estimated Status					12-31-43 Desired Status			12-31-43 Recommended Status					Recommended for 1943					U.S. Financed Production Only Proposed Delivery Target - 1943												
	No. of Sqds.	Airpl per Sqd	Reqd T.E.	Airpl on Hand or Enroute	Type	No. of Sqds.	Airpl per Sqd	Reqd T.E.	No. of Sqds.	Airpl per Sqd	Reqd T.E.	Type	Add U.S. Req.	Source	Add U.S.	Attr	Total	Type	Comm Serv.	J	F	M	A	M	J	J	A	S	O	N	D	Total
Heavy Bombers 4-E						9	18	162	0		0		0																		
Patrol Bomber 4-E																															
Patrol Bomber 2-E	2	9	18	9	PBY-5	5	9	45	4	9	36	PBY-5	27	U.K.	27	16	43	PBY-5	Navy	7	7	7	5	-	5	-	5	-	5	-	2	43
Medium Bomber 2-E	3	18	54	50	Hudson	2	18	36	2	18	36	B-34	0	U.S.	0	43	43	B-34	Army	-	-	-	2	2	2	2	3	3	3	3	23*
Light Bombers 2-E (Torp)	6	18	108	20	Defort	9	18	162	9	18	162	Defort	142	ADST.																	
Light Bombers 1-E (Dive)	5	24	120	77	A-31,35	9	24	216	5	24	120	A-31,35	43	U.S.	43	222	265	A-31,35	Army	40	30	5	20	20	20	20	20	20	20	20	30	265
Fighters 2-E (Bite)	2	24	48	44	Refight	2	24	48	2	24	48	Refight	4	U.K.																	
					A-20?	5	24	120	0		0		0																			
Fighters 1-E	3	24	72	35	Spits	3	24	72	3	24	72	Spits	37	U.K.																	
—	5	24	120	66	P-40	8	24	192	8	24	192	P-40	124	U.S.	124	136	260	P-40	Army	35	23	20	20	20	20	20	20	20	20	20	22	260
	2	24	48	10	Bomber	6	24	144	6	24	144	Bomber	134	ADST.																	
Scout Observ.	1	18	18	11	Walrus	1	18	18	1	18	18	Walrus	7	U.K.																	
TOTAL COMBAT	29		606	322		49		1215	40		828		520		196	415	611			82	60	32	47	42	47	42	48	43	48	43	57	591*
Heavy Transp 4-E																															
Heavy T (Boat) 2-E						1	9	9	0		0		0																		
Medium Transp 2-E	1	9	9	6	DC-2	10	9	90	4	9	36	C-47	30	U.K.	30	3	33	C-47	Army	1	1	1	5	-	5	-	5	5	5			33
Light Transp 2-E						2	9	18	1	9	9	C-60	9	U.S.	9	1	10	C-60	Army	-	-	-	-	-	-	5	-	-	5	-	-		10
Light Transp 1-E																															
TOTAL SERVICE COMBAT	1		9	6		13		117	5		45		39		39	4	43			1	1	1	5	-	5	5	5	-	10	5	5		43
TOTAL TACTICAL	30		615	328		62		1332	45		873		559		235	419	654			83	61	33	52	42	52	47	53	43	58	48	62	634*

* 20 additional B-34 or A-29 (AT-18) airplanes must be supplied from those assigned to the U.S. Army Air Forces to meet the directive of WDC 90/1.

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TAB "C"

DETAIL OF PROPOSED 1942 AIRCRAFT ALLOCATIONS (U.S.) TO THE AEF

JCS 69/2 - TAB "C"

	12-31-42 Estimated Status					12-31-43 Desired Status			12-31-43 Recommended Status					Incremental for 1943					U.S. Financed Production Only Proposed Delivery Target - 1943											
	No. of Sqdns.	Airpl per Sqd	Req'd U.S.	Airpl on Hand	Type	No. of Sqdns.	Airpl per Sqd	Req U.S.	No. of Sqdns.	Airpl per Sqd	Req U.S.	Type	Add U.S. Req.	Location	Add Sqdns.	Airc	Total	Type	Serv Acft.	J	F	M	A	M	J	J	A	S	O	N	D	Total
Heavy Bombers 4-E						2	18	36	0		0		0																		
Patrol Bomber 4-E																															
Patrol Bomber 2-E	$\frac{1}{2}$	9	4	3	Singapore	1	9	9	2	9	18	PBY-5	14	U.S.	14	10	24	PBY-5	Navy	-	-	4	6	5	-	5	-	3	-	-	-	25
Medium Bomber 2-E	5	18	90	76	Hudson	5	18	90	5	18	90	B-34 (2 sqds in combat) (2 sqds in N.Z.)	14	U.S.	14	91	105	B-34	Army	-	-	-	9	9	9	9	9	9	9	10		82*
Light Bombers 2-E																															
Light Bombers 1-E (Dive) (Torp)						4 2	18 18	72 36	4 2	18 18	72 36	A-24 TBF	72 36	U.S. U.S.	72 34	48 27	120 63	A-24 TBF	Army Navy	-	-	-	-	-	-	20 10	20 10	20 10	20 10	20 10	20 13	120 63
Fighters 2-E						2	18	36	0		0		0																		
Fighters 1-E	3	18	54	47) 25)	P-40	$4\frac{1}{2}$	18	81	$\frac{1}{2}$	18	99	P-40 (1 sqd in combat) (1 sqd in Iceland) ($\frac{1}{2}$ sqd in Norfolk) (3 sqd in N.Z.)	27	U.S.	27	148	175	P-40	Army	20	20	-	10	10	10	10	15	20	20	20	20		175
Scout Observ(Army Coop) (Reconnaissance)	2 3	9 18	18 54	23 Hinds (Obs) 40 Vincents (Obs)		- -		- -	- -		- -	- - (1 sqd in Suva)	- -	U.K.																		
TOTAL COMBAT	$13\frac{1}{2}$		220	$21\frac{1}{2}$		$20\frac{1}{2}$		360	$18\frac{1}{2}$		315	162			164	324	488			20	20	6	25	24	19	54	54	62	59	59	63		465*
Heavy Transp 4-E																															
Medium Trans 2-E						1	9	9	1	6	6	C-47 (U.K. to combat)	6	U.S.	6	0	6	C-47	Army	-	-	1	-	5								6
Light Transp 2-E						1	6	6	1	9	9	C-60 (In S.E.)	9	U.S.	9	0	9	C-60	Army	-	-	4	-	-	-	-	5					9
Light Transp 1-E																															
TOTAL SERVICE COMBAT						2		15	2		15	15			15	0	15			-	-	5	-	5	-	-	5						15
TOTAL TACTICAL						$22\frac{1}{2}$		375	$20\frac{1}{2}$		330	179			179	324	503			20	20	11	25	29	19	54	59	62	59	59	63		480*

* 23 additional B-34 or A-29 (AT-18) airplanes must be supplied from those assigned to the U.S. Army Air Forces to meet the directive of C.C.S. 91/1.

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TABLE

TOTAL OF PROGRAM AND AIRCRAFT ACQUISITION FOR SERVICE USE

Table A

	Recommended for 1947					U.S. Planned Production Only (Projected Delivery Period - 1947)												
	Aid Made	Attr	Total	Type	Dept Acft.	J	F	M	A	M	J	J	A	S	O	N	D	Total
Heavy Bombers 4-E																		
Patrol Bomber 4-E																		
Patrol Bomber 2-E																		
Medium Bomber 2-E			144	B-25	Army	12	12	12	12	12	12	12	12	12	12	12	12	144
Light Bombers 2-E			1200	A-20	Army	60	71	100	120	140	110	100	100	100	100	100	100	1200
Light Bombers 1-E																		
Fighters 2-E																		
Fighters 1-E	(On U.S. Acct)		1200	P-39	Army	100	100	100	130	100	100	100	100	100	100	140	100	1200
	(On U.K. Acct)		1400	P-39	Army	50	50	50	150	150	150	150	150	150	150	150	150	1500
	(On U.K. Acct)		300	P-40	Army	100	100	100	-	-	-	-	-	-	-	-	-	300
Scout Observ.																		
TOTAL COMBAT	(On U.S. Acct)		2544			312	333	362	362	402	381	362	362	362	362	362	362	4344
	(On U.K. Acct)		1400															
Heavy Transp 4-E																		
Medium Trans 2-E			300	C-47	Army	10	10	10	10	20	20	30	30	40	40	40	40	300
Light Transp 2-E																		
Light Transp 1-E																		
TOTAL SERVICE COMBAT			300			10	10	10	10	20	20	30	30	40	40	40	40	300
TOTAL TACTICAL	(On U.S. Acct)		2844			322	343	372	372	422	401	392	392	402	402	402	402	4644
	(On U.K. Acct)		1800															

JCS 69/2 - JAB 307
Page 5 of 10 pages

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U.S. [illegible]

DETAIL OF PROPOSED 1943 AIRCRAFT ALLOCATIONS UNDER DEFENCE ACT

NETHERLANDS

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	1-7-43 Current Status					1-7-43 Projected Status					1-7-43 Recommended Status							Recommended for 1943					U.S. Financed Production Only Proposed Delivery Target - 1943											
	No. of Units	Attrit. per Mo.	Repl. U.K.	Repl. Ordered	Type	No. of Units	Attrit. per Mo.	Repl. U.K.	Type	No. of Units	Attrit. per Mo.	Repl. U.K.	Type	Repl. U.S.	Source	Add U.K.	Attr	Total	Type	Crew Terr.	J	F	M	A	M	J	J	A	S	O	N	D	Total
Heavy Bombers 4-E	-																																
Patrol Bomber 4-E																																	
Patrol Bomber 1-E																																	
Medium Bombers 1-E																																	
Light Bombers 1-E	1 *									1 *	12	12	B-25	C	U.S.	36	36	36	B-25	Army	1	1	2	-	5	-	5	-	5	-	6	7	36 (91 unscheduled)
	1 **									1 **									B-26	Army													0 (48 unscheduled)
11ght Bombers 1-E																																	
Fighters 4-E																																	
Fighters 1-E	1 *									1 *			P-40	C	U.S.	0	40	40	P-40	Army	-	-	-	10	-	10	-	10	-	10	-	-	40
Scout Cheers																																	
TOTAL FIGHTERS	1									1	48	48				0	76	76			1	1	2	10	5	10	5	10	5	10	6	7	76
Heavy Cheers 4-E																																	
Medium Cheers 1-E																																	
Light Cheers 1-E										0-47	7	U.S.				7	0	7	C-47	Army	-	-	-	-	-	-	-	-	1	1	1	3 (6 unscheduled)
11ght Cheers 1-E										0-40	6	U.S.				6	0	6	C-40	Army	-	-	-	1	1	1	1	1	-	-	-	6
TOTAL CHEERS (ABOVE)											13					13	0	13															
																					-	-	-	1	1	1	1	1	1	1	1	1	9
GRAND TOTALS											61					0	76	89			1	1	2	11	6	11	6	11	7	8	8	85

* Operating from Australia.
** One Dutch Light Bomber Squadron serving with Australia operates with the Coastal Command from U.K. It is maintained from U. K. allocations.

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Page 1 of 13 pages.

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SAB 207

DETAIL OF PLANNED 1944 AIRCRAFT ALLOCATIONS UNDER DEFENCE AID

NETHERLANDS

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	U-Class Defended Status					U-Class Neutral Status					U-Class Detrimental Status							Recommended for 1944					U.S. Financed Production Only Proposed Delivery Target - 1944												
	No. of Units	Aircraft Serviceable	Aircraft Unserviceable	Aircraft In Hand	Type	No. of Units	Aircraft Serviceable	Aircraft Unserviceable	Type	No. of Units	Aircraft Serviceable	Aircraft Unserviceable	Type	U.K. Total	Disposition	Add U.K.	Aircraft	Total	Type	Operational Serv.	J	F	M	A	M	J	J	A	S	O	N	D	Total
Heavy Bombers U-S																																		
Patrol Bomber U-S																																		
Patrol Bomber U-S																																		
Medium Bombers U-S																																		
Light Bombers U-S	1 *									1 *									B-25	Army														36 (31 unscheduled)
Light Bombers U-S										1 **									U-10	Army														0 (40 unscheduled)
Fighters U-S																																		
Fighters U-S	1 *									1 *									P-40	Army														40
Patrol Theory																																		
TOTAL COMBAT	2									2																								76
Heavy Trans U-S																																		
Medium Trans U-S																																		
Light Trans U-S																			C-47	Army														3 (6 unscheduled)
Light Trans U-S																			C-45	Army														6
TOTAL CARRIER CAPABLE																																		
TOTAL SQUADRON	2									2																								86

* Operating from Australia.
** The Dutch Light Bomber Squadron under U.S. Air Defence operates with the Coastal Command from U.K. It is maintained from U. S. Allocations.

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SAB 207

Page 6 of 10 Pages.

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TAB "C"

DETAIL OF PROPOSED U.S. ATTACHÉ ALLOCATIONS (NON-DIPLOMATIC)

CHINA

	1-41-42 Estimated Status					1-41-43 Desired Status			1-41-43 Recommended Status						Recommended for 1943					U.S. Financed Production Only Proposed Delivery Target - 1943												
	No. of Ords.	Attyl per Ord	Regd U.S.	Attyl on Hand or Enroute	Type	No. of Ords.	Attyl per Ord	Regd U.S.	No. of Ords.	Attyl per Ord	Regd U.S.	Type	Del by U.S. Reg.	Source	Add U.S.	Attyl	Total	Type	Chan Serv.	J	F	M	A	M	J	J	A	S	O	N	D	Total
Heavy Bombers 4-E																																
Patrol Bomber 4-E																																
Patrol Bomber 2-E																																
Medium Bomber 2-E																																
Light Bombers 2-E			30		Hudson																											
Light Bombers 1-E (dive)									(To be replaced with Dive Bombers)																							
Fighters 2-E									4	24	96	A-24	96	U.S.	96	54	150	A-24	Army	-	-	-	10	10	10	15	15	15	25	25	25	150
Fighters 1-E			120	(P-40 P-43 (P-66					4	72	100	P-40	0	U.S.	0	150	150	P-40	Army	-	-	-	10	10	10	15	15	15	25	25	25	150
Scout Observ.			—						—		—	—			—	—	—			—	—	—	—	—	—	—	—	—	—	—	—
TOTAL COMBAT			300						8		196	96			96	204	300			-	-	-	20	20	20	30	30	30	50	50	50	300
Heavy Transp 4-E																																
Medium Transp 2-E			21	(C-47 (C-53							C-47 12		U.S.		12	12	24	C-47	Army	0	0	0	0	0	0	2	2	2	2	2	2	24
Light Transp 2-E																																
Light Transp 1-E			—								—				—	—	—			—	—	—	—	—	—	—	—	—	—	—	—
TOTAL SERVICE COMBAT			21								12				12	12	24			0	0	0	0	0	0	2	2	2	2	2	2	24
TOTAL TACTICAL			296								108				108	216	324			-	-	-	20	20	20	32	32	32	52	52	52	324

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DETAIL OF PROPOSED U.S. TROOPS AND EQUIPMENT TO BE SENT TO BRAZIL

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	12-31-42 Estimated Status					1-31-43 Desired Status *			1-31-43 Recommended Status						Recommended for 1943					U.S. Financed Production Only Projected Delivery Target - 1943												
	No. of Sqds.	Airpl per Sqd	Reqd U.S.	Airpl on Hand	Type	No. of Sqds.	Airpl per Sqd	Reqd U.S.	No. of Sqds.	Airpl per Sqd	Reqd U.S.	Type	U.S. Less	Source	Ind U.K.	Atlc.	Total	Type	Count Contr.	J	F	M	A	M	J	J	A	S	O	N	D	Total
Heavy Bombers 4-E																																
Patrol Bomber 4-E																																
Patrol Bomber 2-E	1	7	7	8	PBY	2	7	14	1	7	7	PBY-5	7	U.S.		6	6	PBY-5	Navy	1	2	3	-									6
Medium Bomber 2-E						4	7	28	4	7	28	B-25	8	U.S.		14	14	B-25	Army	-	-	-	-	-	-	2	2	2	2	2	2	14
Light Bombers 2-E	4	7	28	28	Hudson	14	7	105	(To be replaced with Medium Bombers)																							
Light Bombers 1-E (dive) (torp)	4	7	28	28	A-31	4 4	7 7	28 28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	2	2	2	10
Fighters 2-E																																
Fighters 1-E	4	10	40	46	P-40	9	10	90	9	10	90	P-40																				
Scout Observ.																																
TOTAL COMBAT	13		103	104		33		266	15		131		15		12	20	32			1	2	3	5	5	7	7	7	7	7	10	13	84
Heavy Transp 4-E																																
Medium Trans 2-E																																
Light Transp 2-E	1	7	7	8		2	7	14	2	6	12	C-47	6	U.S.		4	4	C-47	Army	1	2	-	-	-	1							4
Light Transp 1-E																																
TOTAL SERVICE COMBAT	1		7	8		2		14	2		12		6			4	4			1	2	-	-	-	1							4
TOTAL TACTICAL	14		110	112		35		280	17		143		21		12	24	36			2	4	3	5	5	8	7	7	7	7	10	13	88
Adv. Trainers 1-E																30	30	BT-9	Army	3	3	3	3	3	3	3	3	3	3	3	3	36
Basic Trainer 1-E																55	55	BT-13,15	Army	4	4	4	4	4	4	4	4	4	4	4	5	49
Primary Trainers																10	10	PT-19	Army	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL TRAINERS																95				7	7	7	7	7	7	7	7	7	7	7	8	85
GRAND TOTAL - ALL TYPES																199				9	11	10	12	12	15	14	14	14	14	17	21	173

*Recommendation of Joint Brazil-U. S. Military Commission

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Page 1 of 10 pages.

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	Recommended for 1943					U.S. Planned Production only Proposed Military Deliveries - 1943												
	AAF U.S.	Allies	Total	Type*	Theatre Serv.	J	F	M	A	M	J	J	A	S	O	N	D	Total
Heavy Bombers 4-E																		
Patrol Bombers 3-E																		
Patrol Bombers 2-E																		
Medium Bombers 2-E																		
Light Bombers 1-E																		
Light Bombers 1-S																		
Fighters 1-E	24	6	30	A-24	Army	-	-	-	-	10	10	5	-	-	5	-	-	30
Fighters 1-S																		
Recon Theatr.	12	6	18	P-40	Army	-	-	-	-	-	-	-	5	5	-	5	3	18
TOTAL COMBAT	—	—	—			—	—	—	—	—	—	—	—	—	—	—	—	—
	36	12	48			-	-	-	-	10	10	5	5	5	5	5	3	48
Heavy Transp 4-E																		
Medium Transp 2-E																		
Light Transp 1-E																		
Light Transp 1-S	6	0	6	C-60	Army	-	-	-	-	-	-	1	1	1	1	1	1	6
TOTAL SERVICE COMBAT	—	—	—			—	—	—	—	—	—	—	—	—	—	—	—	—
	6	0	6			-	-	-	-	-	-	1	1	1	1	1	1	6
TOTAL TACTICAL	42	12	54			—	—	—	—	—	—	—	—	—	—	—	—	—
						-	-	-	-	10	10	6	6	6	6	6	4	54
Adv. Trainers 1-E																		
Basic Trainers 1-E			18	AT-6	Army	6	6	6	-	-	-	-	-	-	-	-	-	18
Primary Trainers			20	PT-13/15	Army	-	-	-	2	2	2	2	2	2	3	3		20
			25	PT-19/23	Army	-	-	-	3	3	3	3	3	3	3	1		25
TOTAL TRAINING			63			—	—	—	—	—	—	—	—	—	—	—	—	—
						6	6	6	5	5	5	5	5	5	6	4		63
GRAND TOTAL - ALL TYPES			117			—	—	—	—	—	—	—	—	—	—	—	—	—
						6	6	6	5	15	15	11	11	11	11	12	8	117

*Estimate (C/rt/Ac) of Latin American Theatre Group, OPD, G.S.

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DETAIL OF PROPOSED 1943 AIRCRAFT ALLOCATIONS TO BE SUPPLIED BY

LATIN AMERICA (EXCEPT BRAZIL & MEXICO)

	Recommended for 1943				U.S. Planned Production 1943 Projected Delivery Target - 1943												
	Add U.K.	Attr	Total	Type	Dept Serv.	J	F	M	A	M	J	J	A	S	O	N	D	TOTAL
Heavy Bombers 4-E																	
Patrol Bomber 4-E																	
Patrol Bomber 2-E																	
Medium Bomber 2-E																	
Light Bombers 2-E																	
Light Bombers 1-E			45*	A-24	Army	-	-	-	5	5	5	5	5	5	5	5	5	45*
Fighters 2-E																	
Fighters 1-E			45*	P-40	Army	-	-	-	5	5	5	5	5	5	4	3	3	45*
Scout Observ.																	
TOTAL COMBAT			90			-	-	-	10	10	10	10	10	10	9	8	8	90
Heavy Transp 4-E																	
Medium Trans 2-E																	
Light Transp 2-E			9*	C-60	Army	1**	-	-	1	1	1	1	1	1	1	-		9*
Light Transp 1-E																	
TOTAL SERVICE COMBAT			9			1	-	-	1	1	1	1	1	1	1	-		9
TOTAL TACTICAL			99			1	-	-	11	11	11	11	11	11	11	10		99
Adv.Trainers 1-E			175	AT-6	Army	8	8	8	16	16	17	19	17	17	17	17	17	175
Basic Trainer 1-E			245	BT-13,15	Army	20	20	20	20	20	21	21	21	21	20	21		245
Primary Trainers			136	PT-17,19	Army	7	7	7	7	7	7	7	15	17	17	17	21	136
TOTAL TRAINERS			556			35	35	35	43	43	45	47	53	55	54	55	59	556
GRAND TOTAL ALL TYPES			655			36	35	35	54	54	55	58	64	66	64	65	69	655

* Represents tentative allocations for Latin American countries other than Brazil and Mexico. Actual assignments must be contingent upon proper requisitions and approval by our State Department.

** Assigned by Munitions Assignments Board for delivery to Colombia.

*** assigned by Munitions Assignments Board.

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TAB "A"

SUMMARY OF PROGRAMED [illegible] AIRCRAFT ALLOCATIONS TO U. S. NAVY

S E C R E T

CLASS	TYPE	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	TOTAL
Heavy Bombers 4-E (Army)	PB-1(B-24)	22	22	22	22	32	32	32	40	40	40	40	375
	TOTAL HB-4E	20	20	20	20	30	30	30	40	40	40	40	375
Patrol Bomber 4-E	PBY-3	39	39	39	38	43	43	48	58	58	58	58	537
	TOTAL PB-4E	30	34	34	38	43	43	48	58	58	58	58	537
Patrol Bomber 2-E	PBY,PBA	69	61	63	71	76	71	71	71	71	71	71	765
	PBM	40	40	40	40	40	40	48	48	48	48	48	570
	P-3Y									1	2	7	10
	TOTAL PB-2E	109	101	103	111	116	111	119	119	120	121	126	1345
Medium Bomber 2-A (Army)	PBJ(B-25)									33	33	36	102
	PV-1(B-34)	26	32	41	43	39	39	33	41	42	42	47	395
	TOTAL MB-2A	26	32	41	43	39	39	33	41	42	42	47	395
Lt.Bt B(Dive) 1-A	SBC-4	35	41	93	66	81	81	80	76	73	73	83	908
	SBC												503
	SBC-3												2492
	SBC-4			1									112
	SBD	141	212	240	250	250	250	250	250	250	250	150	2741
	SBF								1	3	5	15	34
	SBW												
	ASC-1				3	13	16	22	31	45	45	45	266
												1	1
	TOTAL LB(Dive)	273	334	417	479	426	433	452	438	483	547	449	6149
Light B(Torp) 1-A	TBF	115	131	132	109	108	115	110	150	110	45	42	1317
	TBM	11	21	4	62	40	139	10	190	200	235	240	1635
	TBU									1	3	10	14
	ATSC								1	2	1		4
	TOTAL LB(Torp)	126	152	136	171	148	254	120	341	313	284	292	2970
Fighters 1-E	F3A												
	F4F	141		1	5	15	15	40	75	100	105	125	631
	F6F	41											141
	F4U	30	64	90	125	135	160	125	200	200	250	130	2995
	FG		120	120	130	170	140	160	175	175	175	175	1705
	FM	19	32	2	12	10	75	110	125	150	175	200	1176
	F14C-1			40	66	50	145	110	125	170	145	200	1207
			1			1	1	1					4
	TOTAL F-1E	291	436	296	323	381	536	551	700	795	850	1055	7074
Scout Observation	SO3C	45	45	45	45	50	50	50	50	50	50	50	530
	SOE			1	5	12	12	12	12	12	12	20	104
	TOTAL S.O.	47	49	46	48	55	73	75	62	74	74	62	784
Heavy Transp 4-E (Army)	C-54(R5D-1)	2	2	3	3	3	4	4	4	5	5	5	45
	TOTAL HT-4E	2	2	3	3	3	4	4	4	5	5	5	45
Heavy Transp 2-A (Army)	C-46(R5C-1)	2	4	6	6	6	11	12	12	1	12	13	113
	TOTAL HT-2A	2	4	6	6	6	11	12	12	12	12	13	113

S E C R E T

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Page 1 of 2 Pages

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TAB "D"

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SUMMARY OF PROCURED (NEW) AIRCRAFT ALLOCATIONS TO U. S. NAVY

CLASS	TYPE	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT	OCT.	NOV.	DEC.	TOTAL
Medium Transp 2-E (Army)	C-47 (R4D-1)	6	6	6	12	15	15	20	20	25	25	25	25	206
	TOTAL MT-2E	6	6	6	12	15	15	20	20	25	25	25	25	206
Medium Transp 2-E	RB-1					3	3	1	2	1	1	1	1	13
	TOTAL MT-2E					3	3	1	2	1	1	1	1	13
Light Transp 2-E (Army)	C-60 (R50-5)	5	5	5	10	10	10	10	12	12	12	12	12	115
	TOTAL LT-2E	5	5	5	10	10	10	10	12	12	12	12	12	115
Light Transp 1&2E	J4F J5F J2F	4	4	4	4	4 4	4 4	4 4	4 4	4 4	5 5	5 5	5 5	50 50
							3	3	3	10	10	10	10	39
	TOTAL LT-1&2E	4	4	4	4	8	11	11	14	20	25	30	30	189
Light Transp 1-E (Army)	C-45 (GB-2)	9	9	8	9	9	8	8	8	8	8	8	8	98
	TOTAL LT-1E	9	9	8	9	9	8	8	8	8	8	8	8	98
Utility 1-E	GE	20	7	7	20	10	4	10	60	60	70	74	80	514
	TOTAL UT-1E	20	7	7	20	10	4	10	60	60	70	74	80	514
Adv. Trainers 2-E (Army)	AT-11 (SNB-1) AT-7 (SNB-2)	34 12	34 10	34 8	35 10	35 10	35 16	35 14	35 14	34 14	30 14	30 14	30 14	414 164
	TOTAL AT-2E	46	46	46	48	50	51	51	53	53	48	48	48	598
Adv. Trainers 1-E (Army)	AT-6 (SNJ-4)	200	200	200	200	200	200	150	100	75	75	50	50	1700
	TOTAL AT-1E	200	200	200	200	200	200	150	100	75	75	50	50	1700
Basic Trainers (Army)	PT-13 (NBW-1)	84	66	70	70	74	74	74	74	74	74	74	74	896
	TOTAL BT-1E	84	66	70	70	74	74	74	74	74	74	74	74	896
Primary Trainers (Army)	PT-17 (N2S-4)	175	175	175	175	175	175	175	155	155	150	150	149	1961
	TOTAL PT-1E	175	175	175	175	175	175	175	155	155	150	150	149	1961
Primary Trainers	BB-1 BT	11 16	14 18	14 22	23 20	43 20	51 20	20	20	24	25	25	25	160 291
	TOTAL PT-1E	27	32	36	43	63	71	20	20	24	25	25	25	451

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Page 2 of 2 Pages

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TAB "A"

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SUMMARY OF PROGRAM FOR AIRCRAFT ALLOCATIONS TO U. S. ARMY

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CLASS	TYPE	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT	OCT.	NOV.	DEC.	TOTAL
Heavy Bombers 4-E														
	B-17	210	135	265	320	345	391	405	440	470	460	460	450	4456
	B-24	134	477	580	470	540	605	635	670	660	770	670	632	6685
	B-29			1	3	5	11	16	31	34	50	73	90	314
	B-32	1	-	1	2	1	2	3	6	6	7	10	15	54
	B-33							1	-	-	1	-	-	2
	AB-35										1	-	-	1
	XB-38					1							1	2
	TOTAL HB-4A	345	612	847	795	891	1009	1060	1147	1170	1287	1213	1188	10611
Patrol Bomber 2-E (Navy)	PBY-5		5											5
	PBY-5A						30	-	-	-	5	10	10	55
	TOTAL PB 2-E		5				30				5	10	10	60
Medium Bomber 2-E														
	B-25	165	165	231	316	430	463	292	317	343	314	314	314	3138
	B-26	130	150	150	135	280	370	400	440	415	450	450	450	3825
	B-37	1	-	-	-	-	-	-	-	-	-	-	-	1
	TOTAL MB-2A	296	315	381	451	710	833	692	757	758	764	764	764	5964
Light Bomber 2-E														
	A-20	20	20	24	30	8	41	113	140	140	140	140	189	1170
	A-26	1						11	17	35	70	110	160	304
	A-29 (AT-15)	50	27	28	30	-	-	-	-	-	-	-	-	135
	TOTAL LB-2A	141	47	72	70	81	90	124	157	215	210	250	349	1662
Light Bombers 1-E														
	A-24	-	5	10	10	20	40	40	40	40	65	70	70	410
	A-25	1	3	6	10	30	50	75	110	140	90	240	240	1130
	AA-32	1	1											2
	A-35	11	55	36	40	65	115	177	145	145	125	125	238	1291
	A-30	140	140	50	-	-	-	-	-	-	-	-	-	330
	TOTAL LB-1A	153	204	102	60	115	205	292	295	325	280	435	548	3122
Light B(dive) 1-E (Navy)	SBD(A-24)	16	16	6										54
	TOTAL LB(Dive)	16	16	6										54
Fighters 2-E														
	P-38	160	200	265	290	260	275	240	290	330	310	320	325	3015
	P-61	3	5	7	15	23	32	40	50	50	50	50	50	377
	AP-07	-	-	-	1	-	-	-	-	-	1	-	-	2
	TOTAL F-2E	163	205	272	306	283	307	280	340	380	361	370	375	3469
Fighters 1-E														
	P-39(P-63)	101	175	251	290	320	420	500	530	410	475	550	550	4572
	P-40	44	204	170	210	260	290	345	395	395	415	395	395	3704
	P-47	109	234	277	345	350	420	445	476	525	475	625	640	5046
	P-51	50	55	141	130	140	170	260	330	270	325	795	290	2276
	P-55					1	-	1	-	1				3
	P-56	1	-	-	1	-	-	-	-	-				2
	P-60						1	3	8	20	50	75	125	282
	P-69			1	-	-	1							2
	XP-77	2	-											6
	TOTAL F-1E	411	668	840	976	1110	1357	1475	1538	1640	1790	1895	1925	15287

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JPS 5/13 TAB "A"
Page 1 of 2 Pages

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TAB "A"

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SUMMARY OF PROPOSED U.S.A.F. AIRCRAFT ALLOCATIONS TO U.S. ARMY

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CLASS	TYPE	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL
Heavy Transp 4-E														
	C-54	5	10	12	9	9	9	10	12	16	22	27	34	173
	C-97	1	1	-	-	1	2	4	6	6	9	9	10	41
	C-87	10	12	12	13	12	12	12	10	10	10	10	10	120
	TOTAL HT-4E	16	23	24	22	22	23	26	28	32	41	46	54	334
Heavy Transp 2-E														
	C-40	33	42	43	47	47	70	45	74	83	86	87	87	615
	AC-54	-	-	-	-	-	1	-	-	1	-	-	-	2
	TOTAL HT-2E	33	42	43	47	47	71	45	74	84	86	87	87	617
Medium Transp 2-E														
	C-47	44	58	79	111	117	177	226	265	299	278	325	360	2279
	C-53	20	20	20	26	26	26	26	20					189
	C-82	-	-	4	8	8	6	7	8	9	10	15	20	83
	C-76	1	3	8	4	15	15	30	50	68	60	118	126	534
	TOTAL MT-2E	65	81	111	147	166	224	274	333	376	348	458	506	3085
Medium Transp 2-E (Navy)	R5-1(C-93)						1	2	4	5	10	15	20	57
	TOTAL MT-2E						1	2	4	5	1	15	20	67
Light Transp 2-E	C-60	23	29	33	33	30	31	30	28	30	31	36	37	374
	TOTAL LT-2E	23	29	33	33	30	31	30	28	30	31	36	37	374
Light Transp LA2-E														
	C-43	0	0	0	0	0	0	0	0	0	0	0	0	72
	C-64	16	18	20	20	20	20	20	20	20	20	20	20	234
	C-64	10	11	13	15	20	25	30	35	40	40	40	40	319
	C-78	50	50	50	50	53	82	82	75	85	85	85	375	601
	TOTAL LT-LA2E	82	85	89	91	99	76	81	65	91	91	114	141	1226
Adv. Trainers 2-E	AT-9,10,17	224	223	234	249	276	297	292	301	215	230	177	50	2740
	AT-7	26	28	25	32	40	47	52	52	42	52	52	52	512
	AT-11	37	37	37	40	40	40	4	40	40	46	46	46	436
	AT-13,15	8	4	8	17	39	48	82	77	28	115	105	130	716
	TOTAL AT-2E	295	292	307	338	386	432	444	469	403	412	379	277	4404
Adv. Trainers 1-E	AT-6	166	191	191	191	191	191	141	91	66	66	91	91	1667
	AT-19									5	50	50	50	155
	TOTAL AT-1E	166	191	191	191	191	191	141	91	71	116	141	141	1826
Basic Trainers	ST-12	5	10	15	20	20	20	20	20	20	20	20	6	196
	ST-13,15	314	334	302	319	397	397	397	397	397	397	397	397	4554
	TOTAL ST-1E	319	344	317	339	417	417	417	417	417	417	417	403	4750
Primary Trainers	PT-17	54	54	69	94	94	94	94	110	110	114	115	118	1121
	PT-19	109	109	109	109	109	174	174	195	175	119	145	139	1371
	PT-23	32	50	75	100	125	150	180	210	240	260	280	290	1992
	PT-25	-	2	-	-	-	-	-	-	-	-	-	-	2
	TOTAL PT-1E	195	215	253	303	328	353	383	425	455	494	539	547	5486

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TAB "F"

SUMMARY OF PROPOSED ARMY AIRCRAFT ALLOCATIONS
FROM U.S. ARMY PRODUCTION COMPLETIONS FOR U.S. NAVY USE
AND FROM U.S. NAVY PRODUCTION COMPLETIONS FOR U.S. ARMY USE

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CLASS	TYPE	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT	OCT.	NOV.	DEC.	TOTAL
FOR U.S. NAVY USE														
Heavy Bombers 4-E	B-24 (PB4Y)	20	20	20	20	10	10	10	10	10	10	10	10	170
Medium Bomber 2-E	B-25 (PBJ)	20	20	20	20	20	20	20	20	20	20	20	20	240
	B-34 (PV-1)	13	13	13	13	13	13	13	13	13	13	13	13	156
	TOTAL MB-2A	33	33	33	33	33	33	33	33	33	33	33	33	396
Heavy Transp 4-E	C-54 (R5D-1)	-	2	3	4	-	6	-	4	-	-	-	1	20
Heavy Transp 2-E	C-46 (R5C-1)	2	4	6	8	8	10	10	10	10	10	10	10	110
Medium Transp 2-E	C-47 (R4D-1)	8	8	8	12	12	15	17	17	17	17	17	17	176
Light Transp 2-E	C-60 (R4D-5)	4	6	6	10	10	10	10	10	10	10	10	10	116
Light Transp 1-E	C-45 (UC-2)	6	6	6	6	6	6	6	6	6	6	6	6	72
Adv. Trainers 2-E	AT-11 (SNB-1)	36	36	36	35	35	35	35	35	35	30	30	30	414
	AT-7 (SNB-2)	10	10	10	12	12	14	14	16	15	16	16	14	165
	TOTAL AT-7A	46	46	46	47	47	49	49	51	50	46	46	44	579
Adv. Trainers 1-E	AT-6 (SNJ-4)	200	200	200	200	200	200	150	150	75	75	50	50	1700
Basic Trainers	BT-13 (SNV-1)	66	66	72	72	72	78	78	78	78	78	78	78	894
Primary Trainers	PT-17 (N2S-4)	175	175	175	175	175	175	175	150	150	150	150	146	1921
*FOR U.S. ARMY USE														
Patrol Bomber 2-E	PBY-5	-	5	-	-	-	-	10	-	-	-	10	10	35
	PBY-5A							20			5	10	10	55
	TOTAL PB-2A		5					30			5	20	20	90
Light B(Dive) 1-E	SBD (A-24)	36	36	6										78
Medium Transp 2-E	RB-1(C-53)							1	2	4	5	10	15	37

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TAB "C"

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SCHEDULE OF U.S. FINANCED AIRCRAFT PRODUCTION FOR 1942

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CLASS	TYPE	MANUFACTURER	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT	OCT.	NOV.	DEC.	TOTAL
Heavy Bombers 4-E															
	B-17	Boeing, Seattle	160	170	180	190	200	220	240	250	260	270	270	270	2680
		Douglas, L.B.	25	30	40	55	65	75	85	95	100	100	100	100	870
		Vega, Burbank	25	35	45	65	78	96	104	104	110	116	116	120	1014
	B-24	Consol, Ft. Worth	5	15	33	52	80	90	115	145	160	175	175	175	1222
		Consol, San Diego	144	148	152	160	175	185	195	210	225	220	220	220	2314
		Douglas, Tulsa	4	3	3	4	5								19
		Ford, Willow Run	15	50	75	105	140	175	225	250	300	350	400	405	2490
		No. Amer., Dallas	1	1	2	4	10	20	40	50	60	75	75	75	413
	B-29	Bell, Atlanta									1	2	5	10	18
		Boeing, Renton							1	1	2	8	15	20	47
		Boeing, Wichita			1	2	5	10	15	20	30	40	50	55	229
		Fisher, Cleveland									1	2	3	5	11
	B-32	Consol, Ft.Worth					1	2	3	4	4	7	10	15	50
		Consol, San Diego	1		1										2
	B-33	Martin, Baltimore							1	-	-	1			2
	XB-35	Northrop, Hawthorne										1	-	1	2
	XB-38	Vega, Burbank					1								1
		TOTAL HB-4E	380	452	532	640	760	872	1024	1131	1253	1367	1459	1491	11364
Patrol Bomber 4-E	PB2Y-3	Consol, San Diego	30	34	38	44	51	52	58	62	65	66	67	68	605
		TOTAL PB-4E	30	34	38	44	51	52	58	62	65	66	67	68	605
Patrol Bomber 2-E	PBY-5,5A	Consol, San Diego	75	75	75	75	75	75	3						453
		Boeing, Vancouver			7	10	20	20	20	20	20	20	20	20	177
		Vickers, Montreal									15	15	15	15	60
	PBN	N.A.F. Phila.	8	10	15	16	16	16	16	16	16	16	16	16	174
	PBM	Martin, Baltimore	40	45	50	55	60	60	60	60	60	60	60	60	670
	PAY	Consol, New Orleans									1	3	5	7	16
		TOTAL PB-2E	123	130	145	156	171	171	99	96	112	114	116	118	1543
Medium Bomber 2-E	B-25	No.Amer, Inglewood	110	100	110	115	124	120	174	124	100	124	120	124	1415
		No.Amer, Kansas City	90	100	115	140	170	200	250	250	240	240	250	250	2544
	B-26	Martin, Baltimore	100	110	120	135	150	165	170	175	185	195	200	210	1965
		Martin, Omaha	30	40	70	100	130	160	190	210	230	240	250	250	1900
	B-34	Vega, Burbank	98	98	108	104	104	104	108	104	104	104	104	108	1244
	B-37	Lockheed, Burbank	5	4											9
		TOTAL MB-2E	433	452	523	594	678	749	892	863	859	913	924	942	8077

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CLASS	TYPE	MANUFACTURER	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL
Light Bombers B-A															
	A-20	Douglas, Los Angeles	80	109	130	145	170	190	220	240	275	275	275	275	2375
	A-26	Douglas, El Segundo	1												1
		Douglas, Tulsa						4	11	17	37	71	100	121	363
	A-29	Lockheed, Burbank	6	20	6	44									306
	A-30	Martin, Baltimore	75	71	60	75	75	75	75	75	75	75	75	75	775
		TOTAL B-A	162	200	196	271	245	269	306	332	387	421	450	471	3781
Light Bombers B-A	A-24	Douglas, Tulsa	5	5	15	20	20	25	25	30	30	30	30	30	305
	A-25	Curtiss, St. Louis	3	3	6	10	5	10	10	10	10	10	10	10	1120
	A-27	Martin, Baltimore	40	40	2										82
	A-35	Vultee, Nashville	70	110	80	120	130	200	214	80	240	250	250	250	2227
	AA-32	Brewster, L.I.C.	1	1											2
	A-36	No. Amer., Inglewood	110	110	50	75	75	75	75	75	75	75	75	75	775
		TOTAL B-A	229	268	153	225	230	310	324	195	355	365	365	365	4585
Light B(Dive) B-A	SB-A (A-12)	Brewster, L.I.C. Brewster, L.I.C.	50 50	61 61	53 74	61 86	66 92	66 90	66 71	75	40	32			511 595
	SBC	Curtiss, Columbia	50	90	110	150	180	220	240	270	300	330	300	300	2490
	A35C	Curtiss, Columbia	1												1
	SBD	Douglas, El Segundo			1	1	2	3	4	11	17	20	24	30	113
	SBD	Douglas, El Segundo	165	150	140	175	180	170	150	150	190	150	200	150	2825
	SBF	Fairchild, Kentucky								1	2	5	10	11	34
	SB4	Gen. Corr., Ft. Wa.			2	3	11	11	11	11	11	11	11	11	476
	A35-1	Curtis, Columbus												1	1
		TOTAL B(Dive)	316	301	380	476	531	517	542	519	560	577	611	575	6846
Light B(Torp) B-A	TBF	Grumman, Bethpage	130	165	150	150	150	150	150	150	150	150	150	150	1775
	TBM	Gen. Mtr., Trenton	30	50	50	60	75	150	150	150	150	150	150	150	1615
	TBU	Vultee, Allentown									1	2	10	20	31
	ATBC	Curtiss, Columbus													1
		TOTAL B(Torp)	160	215	200	210	225	300	300	300	301	302	310	320	3422

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TAB "C"

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SUMMARY OF U.S. FINANCED AIRCRAFT PRODUCTION FOR 1943

CLASS	TYPE	MANUFACTURER	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT	OCT.	NOV.	DEC.	TOTAL
Fighters 2-E															
	P-38	Lockheed, Burbank	180	200	225	250	260	270	280	290	300	310	320	325	3210
	P-61	Northrop, Hawthorne	3	5	9	15	23	32	40	50	50	50	50	50	377
	XP-67	McDonnell, Memphis	—	—	—	1	—	—	—	—	—	1	—	—	2
		TOTAL F-2E	183	205	234	266	283	302	320	340	350	361	370	375	3589
Fighters 1-E															
	P-39	Bell, Buffalo	250	325	400	490	524	565	530	340	185	65			3651
	P-63	Bell, Buffalo	1	-	1	10	26	85	218	420	570	700	800	890	3621
	P-40E	Curtiss, Buffalo	174	116	89										379
	P-40F	Curtiss, Buffalo	135	201	136	180	86								738
	P-40M-1	Curtiss, Buffalo			85	140	300	400	450	430	450	450	450	450	3625
	P-47	Curtiss, Buffalo	30	60	60	60	60	40	21						331
		Republic, Evanston	30	25	50	75	125	150	175	200	225	250	275	200	1860
		Republic, Farmingdale	125	125	160	180	200	225	250	275	300	305	350	350	2805
	P-51	No. Amer., Dallas					10	20	50	100	130	200	200	200	910
		No. Amer., Inglewood	60	110	150	180	180	180	180	180	180	180	180	180	1940
	P-55	Curtiss, St. Louis			-		1	-	1	-	1				3
	P-56	Northrop, Hawthorne	1	-	-	1									2
	P-60	Curtiss, Buffalo						1	3	8	20	50	75	125	282
	P-69	Republic, Farmingdale			1	-	-	1							2
	XP-77	Bell, Buffalo	2	4	—	—	—	—	—	—	—	—	—	—	6
		TOTAL F-1E	788	966	1132	1316	1517	1667	1888	1963	2076	2200	2330	2405	20,235
Fighters 1-E															
	FG-1	Goodyear, Akron	-	1	5	15	30	75	100	125	150	175	200	200	1076
	FM-1	East. Air, Linden	22	35	55	80	105	130	150	165	175	190	250	250	1612
	F3A	Brewster, L. I.	-	-	1	5	15	35	50	75	100	125	150	175	731
	F4F	Grumman, Bethpage	141												141
	F4U	Vt. Sky, Stratford	90	100	125	150	175	200	210	225	225	225	225	225	2175
	F6F	Grumman, Bethpage	45	70	100	125	150	180	210	240	275	310	350	350	2405
	P14G-1	Curtiss, Buffalo	-	1	-	-	1	1	1	—	—	—	—	—	4
		TOTAL F-1E	298	207	286	375	476	621	721	830	925	1030	1175	1200	8144
Scout Observation															
	SO3C	Curtiss, Columbus	70	70	70	70	70	70	70	70	70	70	70	70	840
	SOR-1	Ryan, San Diego	-	-	1	3	5	10	15	20	25	30	35	40	184
		TOTAL S.O.	70	70	71	73	75	80	85	90	95	100	105	110	1024

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Page 3 of 5 Pages

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TAB "C"

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CLASS	TYPE	MANUFACTURER	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL
Heavy Transp 4-E															
	C-54A	Douglas, Chicago							1	3	6	14	19	19	62
		Douglas, San Monica	5	12	13	13	13	13	12	13	13	12	13	13	143
	C-69	Lockheed, Burbank	1	1	-	-	1	2	4	6	8	9	9	10	51
	C-87	Consol, Ft. Worth	10	10	10	10	10	10	10	10	10	10	10	10	120
		TOTAL HT-4E	16	23	23	23	24	25	28	32	37	45	51	52	376
Heavy Transp 2-E	C-46	Curtiss, Buffalo	35	45	55	65	75	80	86	90	94	104	100	109	904
	XC-82	Fairchild, Hagerstown	—	—	—	—	—	1	1	1	1	—	—	—	4
		TOTAL HT-2E	35	45	55	65	75	81	85	90	95	104	100	109	908
Medium Trans 2-E	C-47	Douglas, Long Beach	85	100	120	150	190	220	250	280	300	300	300	300	2595
		Douglas, Oklahoma City	-	-	2	11	20	30	43	62	81	106	158	208	721
	C-53	Douglas, San Monica	20	20	25	26	26	26	46	20					209
	C-62	Waco, Troy			1	2	5	6	7	8	9	10	15	20	83
	C-76	Curtiss, Louisville	-	1	4	8	15	25	35	50	65	80	100	100	483
		Curtiss, St. Louis	1	2	1										4
		Higgins, New Orleans	—	—	—	—	—	—	—	—	3	6	12	28	49
		TOTAL MT-2E	106	123	153	197	256	307	361	420	456	502	585	656	4122
Medium Trans 2-E	RB-1	Budd, Philadelphia					1	2	3	6	8	14	25	40	100
		TOTAL MT-2E					1	2	3	6	8	14	25	40	100
Light Transp 2-E	C-60	Lockheed, Burbank	35	40	45	50	50	50	50	50	50	50	50	50	570
		TOTAL LT-2E	35	40	45	50	50	50	50	50	50	50	50	50	570
Light Transp 1A2E	C-43	Beech, Wichita	12	12	12	12	12	12	12	12	12	12	12	12	144
	C-61	Fairchild, Hagerstown	25	30	35	40	40	40	40	40	40	40	40	40	450
	C-64	Noorduyn, Canada	10	11	13	15	20	25	30	35	40	40	40	40	319
	C-78	Cessna, Wichita	50	50	50	50	53	25	25	25	25	25	48	175	601
		TOTAL LT-1A2E	97	103	110	117	125	102	107	112	117	117	140	267	1614
Light Transp 1A2E (Amphib)	JRF	Grumman, Bethpage	4	4	4	4	4	4	4	4	5	5	5	5	52
	J4F	Grumman, Bethpage	4	4	4	4	4	4	4	4	5	5	5	5	52
	J2F	Columbia, V. S.	—	—	—	—	—	1	3	6	10	15	20	20	75
		TOTAL LT(Amphib)	8	8	8	8	8	9	11	14	20	25	30	30	179
Utility 1-E	GR-1	Howard, Chicago	20	-	-	20	10	4	70	80	80	76	74	80	514
		TOTAL UT-1E	20	-	-	20	10	4	70	80	80	76	74	80	514

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CLASS	TYPE	MANUFACTURER	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL
Adv. Trainers 2-E (Transition)	AT-9	Curtiss, St. Louis	5												5
	AT-10	Beech, Wichita	149	149	149	149	147	147	140	140	15				977
		Globe, Ft. Worth	5	5	15	15	45	45	50	50	50	50	50		394
	AT-17	Cessna, Wichita	85	85	85	115	115	145	147	145	145	140	140	147	1364
(Navigation)	AT-7	Beech, Wichita	38	38	38	42	55	65	70	70	70	70	70	70	596
(Bombardier)	AT-11	Beech, Wichita	75	75	75	75	75	75	75	75	75	75	75	75	900
(Gunnery)	AT-13	Fairchild, Bur.				1	3	4	12	20	26	26	45	50	203
	AT-13,14	Fairchild, Hagers.	1	2											8
	AT-15	Bowing, Wichita	-	2	5	15	15	15	20	20	20	20	20	20	172
		Bellanca, N. C.				1	2	3	4	5	10	10	10	10	127
		McDonnell, Memphis			1	1	1	12	20	25	25	30	30	30	176
		TOTAL AT-13	240	240	255	285	426	465	467	505	425	429	447	385	5052
Adv. Trainers 1-E	AT-6	No. Amer., Dallas	435	450	450	450	450	450	450	450	200	200	200	200	4075
	AT-16	Noorduyn, Montreal	75	75	80	80	80	80	80	80	100	100	100	100	1037
	AT-19	Vultee, Wayne	30	30	30	30	30	30	30	30	30	30	30	30	309
		TOTAL AT-19	508	530	560	560	560	560	560	560	330	330	330	330	5521
Basic Trainers	BT-12	Fleetwings, Dr.	5	10	15	20	20	20	20	20	20	20	20	6	196
	BT-13,15	Vultee, Downey	420	425	450	450	500	450	375	350	350	375	500	500	5750
		TOTAL BT-13	425	435	465	470	520	470	395	370	370	395	520	506	5946
Primary Trainers	PT-17	Boeing, Wichita	265	295	290	275	275	275	275	275	275	275	275	275	3195
	PT-19, 26	Fairchild, Hagerstown	150	150	150	150	150	150	150	150	150	150	150	150	1800
	PT-23	Aeronca, Mid.	70	70	70	70	70	70	70	70	110	110	110	110	840
		Howard, Chicago	5	10	5	5	5	5	5	5	5	5	5	5	66
		St. Louis Air.	6	1	1	1	1	1	1	1	6	6	6	6	46
	PT-26	Fleet, Canada	97	97	97	97	97	97	97	97	97	97	97	100	941
	PT-25	Ryan, San Diego	25	25	5										2
		TOTAL PT-13	618	648	618	598	598	598	598	598	643	643	643	646	7130
Primary Trainers	NH-1	Howard, Chicago	25	25	25	25	25	25	12						162
	N2T-1	Timm, Van Nuys	25	25	25	25	25	25	25	25	25	25	25	25	262
		TOTAL PT-19	50	50	50	50	50	50	37	25	25	25	25	25	424

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145.81-23
11 Sept 1941
THE ARCHIVES
OF THE AAF
PICTORIAL OFFICE

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HEADQUARTERS ARMY AIR FORCES

ROUTING AND RECORD SHEET

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(To be filed u... ndence)

Note.—A line will be drawn across sheet after action by each office concerned.

SUBJECT: Army and Navy Estimate of U. S. Overall Production Requirements.

NO.	FROM	TO	DATE	DATA
1.	AAF S/AS	AAF AAG	1941 12-4	AAF/AS AWV/cmc 1. It is desired that the following information be furnished immediately over the signature of the Air Adjutant General: The names of the persons who had access at any time to the document "Army and Navy Estimate of U.S.Overall Production Requirements", copy number 35. A.W.V. Secretary, Air Staff
2.	Air AG	Sec. Air Staff	12-4	1. Copy of #35 of the above mentioned document was received in this office on November 25, 1941. The case was handled by Mr. Dobson who made a brief record entry of it on a card and turned it over to the undersigned, with a Buck Slip for initialing, sending it to the Secretary of the Air Staff and to the Chief of the Army Air Forces. It was taken by Miss Ingram to Miss Root, who receipted for it. On November 27, 1941 it was received back with the following penciled note thereon "Air A.G.: This is for your files. C. of A.A.F. has seen this. E.P.C." Miss Ingram noted this fact on the record card and turned it over to Mr. Gray who checked it to file. It was filed by Miss Ingram in a combination lock file case where it remained until called for this morning by Captain J. Harper, Air War Plans Division, for check. It is now in my files. W. W. DICK, Air A. G.

DECLASSIFIED DOD DIR 5200.9, 27 Sep 58

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HEADQUARTERS ARMY AIR FORCES

ROUTING AND RECORD SHEET

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File No. .....

Tally No. AAF .....

SUBJECT: Army and Navy Estimate of U. S. Overall Production Requirements.

NO.	FROM	TO	DATE	COMMENTS
				AAF/AS AWV/cmc
1.	AAF S/AS	OCAC C/AC	1941 12-4	1. It is desired that the following information be furnished immediately over the signature of the Acting Chief of Air Corps or Executive of the Office, Chief of Air Corps The names of the persons who had access at any time to the document "Army and Navy Estimate of U.S. overall Production Requirements", copy number 34. A.W.V., Secretary, Air Staff
2.	C/AC	AAF C/AS	1941 12-4	MEG:ds 1. The following persons in the Office, Chief of the Air Corps, had access to the subject report: Executive Division: Brig. Gen. Muir S. Fairchild Lt. Col. M. E. Gross Major H. W. Bowman Major A. S. Barnhart Major B. H. Merchant Lt. Col. John F. McBlain Miss Catherine Haynes Air Service Command, Liaison. Major W. T. Hefley Lt. Col. Lyman P. Whitten MATERIEL DIV: Mrs. Fauntleroy Major F. I. Ordway Mrs. Reva L. Applebaum Colonel B. E. Meyers The report was held overnight in a safe in the Mat. Div. Mail Room. The following persons have the combination to this safe: 1. Lt. Col. D. F. Fritch 2. Mrs. Reva L. Applebaum, 3.Mr. H.A. Kreitzer, 4. Mr. Frederick Joseph Close. The report was also held overnight in the safe of the Air Serv. Command Liaison Sect.The following persons have the combination to this safe:--1.Lt.Col. L. P. Whitten, Major W.T.Hefley and 3. Major J. P. Newberry. M.S.F. Executive.

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File No. _____

Tally No. AAF/ _____

Subject: Army & Navy Estimate of U. S. Overall Production Requirements.

NO.	FROM	TO	DATE	COMMENTS
1.	AAF S/AS	AAF A-4	1941 12-4	1. The following information covering the document, Army and Navy Estimate of U. S. Overall Production Requirements (Copy No. 26); will be furnished immediately, over the signature of the Chief of Division: The name of the persons or person who had access at any time to the above document. AWV S/AS
2.	AAF A-4	AAF S/AS	12-4	The document in question has been accounted for continuously since its receipt in the A-4 Division and has been either in the safe or in the hands of Lt. Col. John F. Whiteley or 1st Lt. W. R. Burt, both of this Division. EPS C/A-4

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File No. _ _ _ _ _ _ _ _

Tally No. AAF/_ _ _ _ _ _

Subject: Army and Navy Estimate of U. S. Overall Production Requirements.

NO.	FROM	TO	DATE	COMMENTS
1.	AAF S/AS	AAF A-3	1941 12-4	1. The following information covering the document "Army and Navy Estimate of U. S. Overall Production Requirements" (Copy No. 29), will be furnished immediately, over the signature of the Chief of Division: The name of the person or persons who had access at any time to the above document. AWV S/AS
2	AAF A-3	AAF C/AS	12-4	AAF/A-3 OSP:meb 1. The following persons of the A-3 Division had access to the safe in which Copy No. 29 of "Army and Navy Estimate of U. S. Overall Production Requirements" was kept: Colonel Earl L. Naiden Lieutenant Colonel Hoyt S. Vandenberg Major Oliver S. Picher. 2. This copy was signed by Mr. Joseph S. Imirie, Chief Clerk of the A-3 Division who transmitted it to the Organization and Equipment Section. Earl L. Naiden ELN C/A-3

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File No. _ _ _ _ _ _ _ _

Tally No. AAF/ _ _ _ _ _ _

Subject: Army and Navy Estimate of U. S. Overall Production Requirements.

NO.	FROM	TO	DATE	COMMENTS
1.	AAF S/AS	AAF A-2	1941 12-4	1. The following information covering the document, "Army and Navy Estimate of U. S. Overall Production Requirements (Copy No. 31) will be furnished immediately, over the signature of the Chief of Division: The name of the person or persons who had access at any time to the above document. ARMY S/AS
2.	AAF A-2	AAF S/AS	1941 12/4	AAF/A-2 MCC-vbw 1. Names of persons who had access to the document referred to in item No. 1 are as follows: Col. T. J. Koenig Brig. General Martin F. Scanlon Capt. Merian C. Cooper Capt. J. T. McCall Miss Mary E. Conry Miss Helen E. Jackson M. F. S. C/A-2

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Tally No. AAF/ _ _ _ _ _ _

Subject: Army and Navy Estimate of U. S. Overall Production Requirements.

NO.	FROM	TO	DATE	COMMENTS
1.	AAF S/AS	AAF A-1	1941 12-4	1. The following information covering the document "Army and Navy Estimate of U. S. Overall Production Requirements" (Copy No.32), will be furnished immediately, over the signature of the Chief of Division: The name of the person or persons who had access at any time to the above document. AWV S/AS
2.	AAF A-1	AAF S/AS	1941 12/4	AAF/A-1 CDP/mlo 1. The following persons in this Division had access to the above document: Lt. Col. R. E. Nugent Lt. C. D. Price Mary M. Robbins Florence Penn Jule Rising Roberta Grable RPC R.P.C. C/A-1

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HEADQUARTERS ARMY AIR FORCES

ROUTING AND RECORD SHEET

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File No. .....

Tally No. AAF .....

SUBJECT: Army and Navy Estimate of U.S. Overall Production Requirements.

NO.	FROM	TO	DATE	COMMENTS
1	AAF S/AS	AAF AWPD	1941 12/4	AAF/AS AWV/cmc 1. It is desired that the following information be furnished immediately over the signature of the Chief of the Division: The names of the persons who had access at any time to the document "Army and Navy Estimate of U.S. Overall Production Requirements". AWV Secretary, Air Staff
2	AAF AWPD	AAF S/AS	12/4	AAF/AS HLG-dmn 1. The following officers and civilian personnel in the Air War Plans Division have had access to the document "Army and Navy Estimate of U.S. Overall Production Requirements": Lt. Col. O. A. Anderson Lt. Col. K. N. Walker Lt. Col. H. L. George Major H. S. Hansell Miss Dorothy M. Nilson Mr. T. L. McPherson 2. Until the distribution of the Plan referred to was made to the several agencies of the Army Air Forces - on November 25th - the following personnel were the only individuals who had had access to the Plan: Lt. Col. O. A. Anderson Lt. Col. K. N. Walker Lt. Col. H. L. George Major H. S. Hansell Miss Dorothy M. Nilson Mr. T. L. McPherson H.L.G. HLG C/A-WPD

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THE JOINT CHIEFS OF STAFF

JOINT U. S. STRATEGIC COMMITTEE

WASHINGTON

Distributed

December 24, 1942.

(Copy Nos. 18, 19, 20)

At the request of Major Burt, three (3) of the ten (10) copies referred to in the attached letter have been sent direct to General Meyers.

C.F. Barber

C.F. BARBER,
Secretary.

Distrib:
1 - Ten Own
1 - Policy
1 - Staff Planners
2 - Strategical Plans
1 - Col Langmaid

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Receipts

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SECRET

Receipt No. _____ December 6, 1941

RECEIPT FOR SECRET OR CONFIDENTIAL DOCUMENT

SUBJECT: Army and Navy Estimate of U.S. Overall Production Requirements.

Receipt is acknowledged of Copy No. 26 for the _____, subject same as above dated September 11, 1941.

_____
Officer. Rank.

Col. York

JOHN Y. YORK
Col. A.C.

_____
Office

NOTE: To be accomplished and returned to the Secretary, Air War Plans Division.

This receipt replaces receipt dated 12/4/41 signed by Col. Whiteley, A-4.

SECRET

AAF-70

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Receipt No. _____ _____

RECEIPT FOR SECRET OR CONFIDENTIAL DOCUMENT

SUBJECT:

Receipt is acknowledged of Plans part 1 for

the _____, subject _____

_____

dated _____.

_____
Officer. Rank.

_____
Office

NOTE: To be accomplished and returned to the Secretary, Air War Plans Division.

AAF-70

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Receipt No. _____ _____

RECEIPT FOR SECRET OR CONFIDENTIAL DOCUMENT

SUBJECT:

Receipt is acknowledged of Plans Div for

the _____, subject _____

_____

dated _____.

_____
Officer. Rank.

_____
Office

NOTE: To be accomplished and returned to the Secretary, Air War Plans Division.

AAF-70

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WAR DEPARTMENT
Headquarters Army Air Forces
Office Chief of the Air Staff
Washington, D.C.

Date 3/14/42

TO:

This document cannot be located by any one in A-4 and Col. York says he would not know where it is.

Miss Alexander

A-W P. DIVISION

X-225-E, A.C.

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Receipt No. _____ _____

RECEIPT FOR SECRET OR CONFIDENTIAL DOCUMENT

SUBJECT:

Receipt is acknowledged of Copy No 33 for the _____, subject _____ Army Navy Estimate Oil Production dated _____.

_____
Officer. Rank.

_____
Office

NOTE: To be accomplished and returned to the Secretary, Air War Plans Division.

AAF-70

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SECRET

Receipt No. _____ December 1, 1941.

RECEIPT FOR SECRET OR CONFIDENTIAL DOCUMENT

SUBJECT: Army and Navy Estimate of U.S. Overall Production Requirements.

Receipt is acknowledged of Copy No. 34 for the _____, subject same as above dated September 11, 1941.

This item seen — Col Whittemore's office 9:30 AM Dec 4 1941

A.A. Ramhan Jr Major A.C.
Officer. Rank.

Office Chief of Air Corps
Office

NOTE: To be accomplished and returned to the Secretary, Air War Plans Division.

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WAR DEPARTMENT
Headquarters Army Air Forces
~~Office~~ Chief of the Air Staff
Washington, D.C.

Date 3-14-42

TO:

Maj. Taylor has agreed to let A-2 retain document until after F.B.I. investigation is Completed.

A-W.P. DIVISION

X-225-E, A.C.

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Copy No. 35 was signed by Mr. Gray.

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Correspondence

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WAR DEPARTMENT
HEADQUARTERS OF THE ARMY AIR FORCES
WASHINGTON December 4, 1941

MEMORANDUM For Chief, Air War Plans Division.

SUBJECT: Strategical and Joint Planning Group.

1. The following personnel are assigned to the above Group:

Lt. Col. K. N. Walker.
Major G. M. Taylor.
Major Ford L. Fair.
Capt. Frank B. Alling.
Miss Amelia Alexander.

2. The undersigned is the only member of the Group who has had access to the Army and Navy Joint estimates in question, other than the Secretary, Miss Painter, who prepared the R&R's for distribution. See Miss Painter's certificate appended hereto.

K. N. Walker,
Lieut. Col., AAF.

1 Incl. - Ctft.

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December 4, 1941

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K. N. Walker,
Lieut. Col.,AAF.

1 Incl. - Ctft.

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WAR DEPARTMENT
HEADQUARTERS OF THE ARMY AIR FORCES
WASHINGTON Dec. 4, 1941

I certify that on Nov. 25, 1941, I prepared a Secret R&R from Air War Plans Division to the following:

AAC, A-1, A-2, A-3, A-4, OCAC.

by which was transmitted copies of the Army and Navy estimates of the United States over all production requirements. Upon preparation of the R&R Iaffixedan appropriate copy to each of the copies of the estimates to be distributed and delivered them immediately to the Chief Clerk, Air War Plans Division for distribution.

I am totally unaware of the contents of this estimate; no copy left my hands from the time they were given to me by Col. Walker in order to append the R&R forms, until I delivered them to the Chief Clerk.

Dranon Painter

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December 5, 1941.

MEMORANDUM FOR COLONEL SCOBEY, SECRETARY, JOINT BOARD:

Subject: Army and Navy Estimate of U.S. Overall Production Requirements.

There is listed below the names of all persons in the several Divisions of the Air Staff and agencies of the Office Chief of Air Corps whose duties made it possible for them to have had access to a copy of the document "Army and Navy Estimate of U.S. Overall Production Requirements".

HEADQUARTERS, ARMY AIR FORCES:

Air Adjutant General:
Col. W. W. Dick
Mr. W. D. Gray
Mr. Dobson
Miss Ingram
Miss S. Root

A-1 Division:
Lt. Col. R. E. Nugent
Lt. C. D. Price
Mary M. Robbins
Florence Penn
Jule Rising
Roberta Grable

A-2 Division:
Brig. Gen. Martin F. Scanlon
Col. T. J. Koenig
Capt. Merian C. Cooper
Capt. J. T. McCall
Miss Mary E. Conry
Miss Helen E. Jackson

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A-3 Division:
Colonel E. L. Naiden
Lt. Col. H. S. Vandenberg
Major O. S. Picher
Mr. J. S. Lairie

A-4 Division:
Lt. Col. J. P. Whiteley — Miss Mary M. Hogan
1st Lt. W. R. Burt — Miss Elsie Drachenberg
Lt. Col. M. F. Schneider — Miss Mary W. Buckley

A-WP Division:
Lt. Col. H. L. George
Lt. Col. K. N. Walker
Lt. Col. O. A. Anderson
Major H. S. Hansell
Miss Dorothy M. Nilson
Mr. T. L. McPherson

Office Chief of Air Corps:
Executive Division:
Brig. Gen. M. S. Fairchild
Lt. Col. M. E. Gross
Lt. Col. J. F. McBlain
Major H. W. Bowman
Major A. S. Barnhart
Major B. H. Merchant
Miss Catherine Haynes

Air Service Command, Liaison:
Lt. Col. L. P. Whitten
Major W. T. Hefley
Major J. P. Newberry
Mrs. Fauntleroy

Materiel Division:
Colonel B. E. Meyers
Lt. Col. D. F. Fritch
Major F. I. Ordway
Mrs. Reva L. Applebaum
Mr. H. A. Kreitzer
Mr. F. J. Close

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Until the distribution of the Plan referred to was made to the several agencies of the Army Air Forces - on November 25th - the following personnel were the only individuals who had had access to the Plan:

Lt. Col. O. A. Anderson
Lt. Col. H. L. George
Lt. Col. K. N. Walker
Major H. S. Hansell
Miss Dorothy M. Wilson
Mr. T. L. McPherson

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December 5, 1941.

MEMORANDUM FOR COLONEL SCOBEY, SECRETARY, JOINT BOARD:

Subject: Army and Navy Estimate of U.S. Overall Production Requirements.

There is listed below the names of all persons in the several Divisions of the Air Staff and agencies of the Office Chief of Air Corps whose duties made it possible for them to have had access to a copy of the document "Army and Navy Estimate of U.S. Overall Production Requirements".

HEADQUARTERS, ARMY AIR FORCES:

Air Adjutant General:
- Col. M. W. Dick
- Mr. W. D. Gray
- Mr. Dobson
- Miss Ingram
- Miss S. Root

A-1 Division:
- Lt. Col. R. E. Nugent
- Lt. C. D. Price
- Mary M. Robbins
- Florence Fenn
- Jule Rising
- Roberta Grable

A-2 Division:
- Brig. Gen. Martin F. Scanlon
- Col. T. J. Koenig
- Capt. Marian C. Cooper
- Capt. J. T. McCall
- Miss Mary E. Conry
- Miss Helen E. Jackson

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A-3 Division:
Colonel E. L. Naiden
Lt. Col. H. S. Vandenberg
Major O. S. Picher
Mr. J. S. Imirie

A-4 Division:
Lt. Col. J. F. Whiteley — Miss Mary H. Hogan
1st Lt. W. R. Burt — Miss Elsie Drachenberg
Lt. Col. M. F. Schneider — Miss Mary W. Buckley

A-WF Division:
Lt. Col. H. L. George
Lt. Col. K. N. Walker
Lt. Col. O. A. Anderson
Major H. S. Hansell
Miss Dorothy M. Nilson
Mr. T. L. McPherson

Office Chief of Air Corps:
Executive Division:
Brig. Gen. M. S. Fairchild
Lt. Col. M. E. Gross
Lt. Col. J. F. McBlain
Major H. W. Bowman
Major A. S. Barnhart
Major B. H. Merchant
Miss Catherine Haynes

Air Service Command, Liaison:
Lt. Col. L. P. Whitten
Major W. T. Hefley
Major J. P. Newberry
Mrs. Fauntleroy

Materiel Division:
Colonel B. E. Meyers
Lt. Col. D. F. Fritch
Major F. I. Ordway
Mrs. Reva L. Applebaum
Mr. H. A. Kreitzer
Mr. F. J. Close

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Until the distribution of the Plan referred to was made to the several agencies of the Army Air Forces - on November 25th - the following personnel were the only individuals who had had access to the Plan:

Lt. Col. O. A. Anderson
Lt. Col. H. L. George
Lt. Col. K. N. Walker
Major H. S. Hansell
Miss Dorothy M. Wilson
Mr. T. L. McPherson

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Army and Navy Estimate of U. S. Overall Production Requirements.

					AAF/AS ANV/cmc
1	AAF S/AS	AAF AAG	1941 12-4	1. It is desired that the following information be furnished immediately over the signature of the Air Adjutant General:	
				The names of the persons who had access at any time to the document "Army and Navy Estimate of U.S.Overall Production Requirements", copy number 35.	
				A.W.V. Secretary, Air Staff	
2	Air AG	Sec. Air Staff	12-4	1. Copy of #35 of the above mentioned document was received in this office on November 25, 1941. The case was handled by Mr. Dobson who made a brief record entry of it on a card and turned it over to the undersigned, with a Buck Slip for initialing, sending it to the Secretary of the Air Staff and to the Chief of the Army Air Forces. It was taken by Miss Ingram to Miss Root, who receipted for it.	
				On November 27, 1941 it was received back with the following penciled note thereon "Air A.G.: This is for your files. C. of A.A.F. has seen this. E.P.C." Miss Ingram noted this fact on the record card and turned it over to Mr. Gray who checked it to file. It was filed by Miss Ingram in a combination lock file case where it remained until called for this morning by Captain J. Harper, Air War Plans Division, for check. It is now in my files.	
				W. W. DICK, Air A. G.	

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Army and Navy Estimate of U. S. Overall Production Requirements.

	AAF	AAF	1941	
1	S/AS	A-1	12-4	1. The following information covering the document "Army and Navy Estimate of U. S. Overall Production Requirements" (Copy No. 32), will be furnished immediately, over the signature of the Chief of Division:

The name of the person or persons who had access at any time to the above document.

AWV
S/AS

AAF/A-1
CDP/mlo

	AAF	AAF	1941	
2	A-1	S/AS	12/4	1. The following persons in this Division had access to the above document:

Lt. Col. R. E. Nugent
Lt. C. D. Price
Mary M. Robbins
Florence Penn
Jule Rising
Roberta Grable

R.P.C.
C/A-1

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Army and Navy Estimate of U. S. Overall Production Requirements.

	AAF	AAF	1941	
1	S/AS	A-2	12-4	1. The following information covering the document, "Army and Navy Estimate of U. S. Overall Production Requirements (Copy No. 31) will be furnished immediately, over the signature of the Chief of Division:

The name of the person or persons who had access at any time to the above document.

AMV
S/AS

AAF/A-2
MCC-vbw

2	AAF	AAF	1941	1. Names of persons who had access to the document
	A-2	S/AS	12/4	referred to in item No. 1 are as follows:

Col. T. J. Koenig
Brig. General Martin F. Scanlon
Capt. Merian C. Cooper
Capt. J. T. McCall
Miss Mary E. Conry
Miss Helen E. Jackson

M.F.S.
C/A-2

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Army and Navy Estimate of U. S. Overall Production Requirements.

1. AAF S/AS — AAF A-3 — 12-4

1. The following information covering the document "Army and Navy Estimate of U.S. Overall Production Requirements" (Copy No. 20), will be furnished immediately, over the signature of the Chief of Division:

The name of the person or persons who had access at any time to the above document.

AAF
S/AS

2 AAF A-3 — AAF C/AS — 12-4

AAF/A-3
OSF:meb

1. The following persons of the A-3 Division had access to the safe in which Copy No. 20 of "Army and Navy Estimate of U. S. Overall Production Requirements" was kept:

Colonel Earl L. Naiden
Lieutenant Colonel Hoyt S. Vandenberg
Major Oliver S. Picher.

2. This copy was signed by Mr. Joseph S. Imirie, Chief Clerk of the A-3 Division who transmitted it to the Organization and Equipment Section.

EIN
C/A-3

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Army & Navy Estimate of U.S. Overall Production Requirements.

	AAF	AAF	1941	
1.	S/AS	A-4	12-4	1. The following information covering the document, Army and Navy Estimate of U. S. Overall Production Requirements (Copy No. 26); will be furnished immediately, over the signature of the Chief of Division:

The name of the persons or person who had access at any time to the above document.

AWV
S/AS

2.	AAF	AAF	12-4	The document in question has been accounted for continuously since its receipt in the A-4 Division and has been either in the safe or in the hands of Lt. Col. John F. Whiteley or 1st Lt. W. N. Burt, both of this Division.
	A-4	S/AS		

WPS
C/A-4

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Army and Navy Estimate of U.S. Overall Production Requirements.

1	AAF S/AS	AAF AWPD	1941 12/4	AAF/AS AWV/cmc 1. It is desired that the following information be furnished immediately over the signature of the Chief of the Division: The names of the persons who had access at any time to the document "Army and Navy Estimate of U.S. Overall Prodduction Requir ments". AWV Secretary, Air Staff
2	AAF AWPD	AAF S/AS	12/4	AAF/AS HLG-dmn 1. The following officers and civilian personnel in the Air War Plans Division have had access to the document "Army and Navy Estimate of U.S. Overall Production Requirements": Lt. Col. O. A. Anderson Lt. Col. K. N. Walker Lt. Col. H. L. George Major H. S. Hansell Miss Dorothy M. Nilson Mr. T. L. McPherson 2. Until the distribution of the Plan referred to was made to the several agencies of the Army Air Forces - on November 25th - the following personnel were the only individuals who had had access to the Plan: Lt. Col. O. A. Anderson Lt. Col. K. N. Walker Lt. Col. H. L. George Major H. S. Hansell Miss Dorothy M. Nilson Mr. T. L. McPherson HLG C/A-WPD

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Army and Navy Estimate of U. S. Overall Production Requirements.

AAF/AS
AWV/cmc

1 AAF S/AS OCAC C/AC 1941 12-4

1. It is desired that the following information be furnished immediately over the signature of the Acting Chief of Air Corps or Executive of the Office, Chief of Air Corps

The names of the persons who had access at any time to the document "Army and Navy Estimate of U.S. overall Production Requirements", copy number 34.

A.W.V.,
Secretary, Air Staff

MMG:ds

2 C/AC AAF C/AS 1941 12-4

1. The following persons in the Office, Chief of the Air Corps, had access to the subject report:

Executive Division:
Brig. Gen. Muir S. Fairchild
Lt. Col. W. E. Gross
Major F. W. Bowman
Major A. S. Barnhart
Major R. H. Merchant
Lt. Col. John F. McClain
Miss Catherine Haynes

Air Service Command, Liaison.
Major W. T. Hefley
Lt. Col. Lyman P. Whitten
Mrs. Fauntleroy

MATERIEL DIV: Major F. I. Ordway
Mrs. Reva L. Applebaum
Colonel B. E. Meyers

The report was held overnight in a safe in the Mat. Div. Mail Room. The following persons have the combination to this safe: 1. Lt. Col. D. F. Fritch 2. Mrs. Reva L. Applebaum, 3. Mr. H.A. Kreitzer, 4. Mr. Frederick Joseph Close.
The report was also held overnight in the safe of the Air Serv. Command Liaison Sect. The following persons have the combination to this safe: 1. Lt. Col. L. P. Whitten, Major W. T. Hefley and 3. Major J. P. Newberry.

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M.S.F.
Executive

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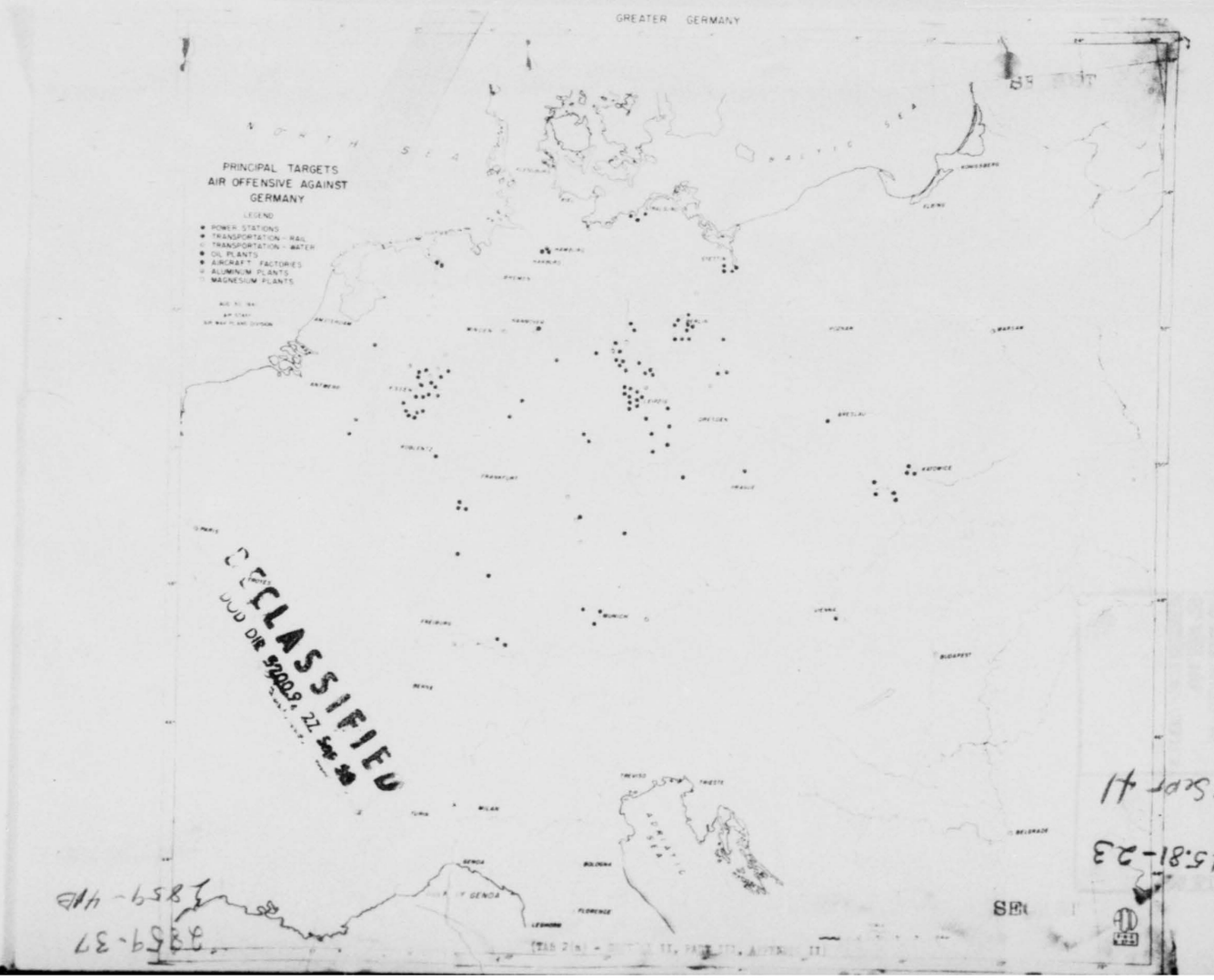

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J.B. No. 355
(Serial 707)

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JOINT BOARD ESTIMATE OF

UNITED STATES OVER-ALL PRODUCTION

REQUIREMENTS

September 11, 1941

I N D E X

Joint Board Estimate of United States Over-All Production Requirements - Report.

Appendix I. Navy Requirements — Decision on Production Requirements for Major Categories of Materials Recommended by the Navy.

Appendix II. Army Requirements:

Part I. Brief of Strategic Concept of Operations Required to Defeat our Potential Enemies (Tabulated Chart).

Part II. Ultimate Requirements — Ground Forces.

Section I. Chart — Distribution and Employment.

Section II. Supporting Study.

Part III. Ultimate Requirements — Air Forces.

Section I. Brief and Graphic Presentation:
Chart No. 1. Tabulated Brief — Munitions Requirements of the Army Air Forces.
Chart No. 2. Air Offensive Against Germany.
Chart No. 3. Air Operations Other Than Those Directed Against Germany Proper.

Section II. Supporting Study: Tabs 1 to 17 (Incl.)

Part IV. Production Requirements — Army Estimate of U. S. Needs and those of Foreign Nations — Critical Items only (Ground and Air) - 20 Charts:

Engineer Equipment.....2 charts
Ordnance Equipment.....8 "
Quartermaster - Motor Transportation....1 "
Quartermaster - Clothing & Equipment....2 "
Signal Corps Equipment (Air Corps).....1 "
Signal Corps Equipment (Ground Forces)..2 "
Air Corps Supplies (For Arms & Services Other than Air Corps).....1 "
Medical Equipment.....1 "
Chemical Warfare Service.....1 "
Requirements for planes.....1 "

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JOINT BOARD ESTIMATE OF UNITED STATES OVER-ALL PRODUCTION REQUIREMENTS.

SEPTEMBER 11, 1941.

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THE JOINT BOARD.
WASHINGTON.

September 11, 1941.

JOINT BOARD ESTIMATE OF
UNITED STATES OVER-ALL PRODUCTION
REQUIREMENTS.

I. DIRECTIVE.

1. The directive requesting the Secretaries of War and of the Navy to undertake an exploration of over-all production requirements of the United States is contained in a letter from the President. This letter, which was referred to the Joint Board for recommendation, is quoted as follows:

"July 9, 1941.

My dear Mr. Secretary:

I wish that you or appropriate representatives designated by you would join with the Secretary of War and his representatives in exploring at once the over-all production requirements required to defeat our potential enemies.

I realize that this report involves the making of appropriate assumptions as to our probable friends and enemies and to the conceivable theatres of operation which will be required.

I wish you would explore the munitions and mechanical equipment of all types which in your opinion would be required to exceed by an appropriate amount that available to our potential enemies. From your report we should be able to establish a munitions objective indicating the industrial capacity which this nation will require.

I am not suggesting a detailed report but one that, while general in scope, would cover the most critical items in our defense and which could then be related by the OPM into practical realities of production facilities. It seems to me we need to know our program in its entirety, even though at a later date it may be amended.

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I. DIRECTIVE (Cont'd)

I believe that the confidential report which I am asking you to make to me would be of great assistance, not only in the efficient utilization of our productive facilities but would afford an adequate opportunity for planning for the greatly increased speed of delivery which our defense program requires.

I am asking Mr. Hopkins to join with you in these conferences. I would appreciate it if the Secretary of War could take the initiative in these conferences.

Very sincerely yours,

/s/ Franklin D. Roosevelt."

2. In solving this problem, it is first necessary to conceive how our potential enemies may be defeated. Having arrived at this conception, it is possible to estimate the military forces required to carry out the operations planned. Once a statement of the major forces is completed, the critical items of equipment may readily be computed.

3. The production requirements mentioned in The President's letter refer to the materials which the United States will be called upon to provide for supporting successful military action against our potential enemies. Any military action by the United States ought to be undertaken only in accordance with sound military policy, necessarily based upon sound strategy. This paper, therefore, will present views as to how the national policy of the United States can best be supported by a military policy which shall guide all military operations, undertaken either by the armed forces of the United States, or by the armed forces of other Powers which may be associated with the United States. Categories of forces and approximate strengths which the United States should raise, or which it should support in whole or in part, will then be listed. In the interest of brevity, lines of reasoning and supporting arguments are omitted.

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JOINT BOARD ESTIMATE OF
UNITED STATES OVER-ALL PRODUCTION
REQUIREMENTS.

II. MAJOR MILITARY POLICY.

4. Germany, and all German-occupied countries whose military forces cooperate with Germany; Japan and Manchukuo; Italy; Vichy France; and possibly Spain and Portugal, are assumed potential enemies. Countries considered as friends or potential associates in warfare the British Commonwealth, the Netherlands East Indies, China, Russia, Free France, peoples in German-occupied territory who may oppose Germany, and the countries of the Western Hemisphere.

5. These major national objectives of the United States which are related to military policy may broadly be stated as: preservation of the territorial, economic and ideological integrity of the United States and of the remainder of the Western Hemisphere; prevention of the disruption of the British Empire; prevention of the further extension of Japanese territorial dominion; eventual establishment in Europe and Asia of balances of power which will most nearly ensure political stability in those regions and the future security of the United States; and, so far as practicable, the establishment of regimes favorable to economic freedom and individual liberty.

6. Since the paramount territorial interests of the United States are in the Western Hemisphere, it is fundamental that the United States must provide armed forces appropriately disposed, which in all eventualities, and operating in cooperation with the forces of other American Powers, can successfully prevent the extension in the Western Hemisphere of European or Asiatic political or military power, even though the British Commonwealth had collapsed.

7. Attainment of this objective alone will not lead to the success of all of the national policies mentioned in paragraph 6. These national policies can be effectuated in their entirety only through military victories outside this hemisphere, either by the armed forces of the United States, by the armed forces of friendly Powers, or by both.

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JOINT BOARD ESTIMATE OF
UNITED STATES OVER-ALL PRODUCTION
REQUIREMENTS.

II. MAJOR MILITARY POLICY. (Cont'd)

8. Should Germany be successful in conquering all of Europe, she might then wish to establish peace with the United States for several years, for the purpose of organizing her gains, restoring her economic situation, and increasing her military establishment, with a view to the eventual conquest of South America and the military defeat of the United States. During such a period of "peace", it seems likely that Germany would seek to undermine the economic and political stability of the countries of South America, and to set up puppet regimes favorable to the establishment on that continent of German military power. In such circumstances, Germany would have better chances to defeat the United States. This concept can not be accepted as certain, because it is conceivable that Germany might at once seek to gain footholds in the Western Hemisphere.

9. Were Japan to defeat China and Russia, and obtain control of Siam, Malaya and the Netherlands East Indies, it is probable that she likewise would endeavor to establish peace for the purpose of organizing the "East Asia Co-Prosperity Sphere". Almost inevitably the Philippine Islands would ultimately pass under Japanese hegemony.

10. It is believed that the overthrow of the Nazi regime by action of the people of Germany is unlikely in the near future, and will not occur until Germany is upon the point of military defeat. Even were a new regime to be established, it is not at all certain that such a regime would agree to peace terms acceptable to the United States.

11. Assuming the truth of the views expressed in the preceding paragraph, it is the opinion of the Joint Board that Germany and her European satellites can not be defeated by the European Powers now fighting against her. Therefore, if our European enemies are to be defeated, it will be necessary for the United States to enter the war, and to employ a part of its armed forces offensively in the Eastern Atlantic and in Europe or Africa.

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JOINT BOARD ESTIMATE OF
UNITED STATES OVER-ALL PRODUCTION
REQUIREMENTS.

II. MAJOR MILITARY POLICY.(Cont'd)

12. The Joint Board also holds the view that, if, under present circumstances, Japan should advance against the British in Malaya and against the Dutch in the Netherlands East Indies, British and Dutch forces probably could not successfully withstand such an advance in the absence of active military assistance by the United States. The result of an attack by Japan on the Eastern Siberian Soviet Republic cannot now be predicted.

13. In view of the preceding considerations, the Joint Board recommends that the over-all production and material objective of the United States be designed to meet United States needs while engaged simultaneously in war against Germany and Japan, under either of the following sets of circumstances:

a. While associated as a belligerent with the British Commonwealth, the Netherlands East Indies, Russia, and China.

b. While associated as a belligerent with Canada and some of the Latin American countries, other belligerent Powers having been defeated by Germany and Japan.

14. Due to inadequate industrial capacity and material resources, friendly Powers must look to the United States for a large part of the munitions and other materials which they will require for success. The munitions and other materials which may be produced or controlled by the United States should be divided between itself and friendly Powers in such a manner as to effectuate the success of the military strategy adopted by the United States as best calculated to defeat our common enemies.

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JOINT BOARD ESTIMATE OF
UNITED STATES OVER-ALL PRODUCTION
REQUIREMENTS.

III. PROBABLE CHARACTER OF THE ENEMY'S MAJOR STRATEGY:

(A) GERMAN STRATEGY:

15. For Germany, the objective of the current phase of the war is the complete military and political domination of Europe, and probably of North and West Africa. If Germany is successful she may then seek a period of peaceful refreshment, during which she can reorganize Europe and prepare for further adventures. However, the possibility can not be dismissed that Germany might seek at once to continue into India, South Africa, or South America.

16. Germany's present major strategic objectives, and the means by which she seeks to attain them, seem to be some or all of the following:

a. The conquest of European Russia, the destruction of the Russian Armies, and the overthrow of the Soviet regime. This is a task for the German army and air forces, and will doubtless absorb most of the energy available to these contingents for some months to come. Final success in this aim is still in the balance.

b. The destruction of the power of resistance of the United Kingdom, through accelerated attrition of shipping, and continued bombing of British facilities. The forces employed will be surface raiders, submarines, and aircraft in the northwestern approaches and down through the Middle Atlantic, operating from bases in Norway, France, Portugal, and French West Africa; and merchant-type raiders distributed throughout all oceans. Invasion of England may possibly not be attempted unless these other measures fail.

c. The conquest of Egypt, Syria, Irak, and Iran. This may be the region in which the next major German offensive will be undertaken. Large land and air forces must be employed, both German and Italian, aided by Italian naval forces in the Eastern Mediterranean and

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JOINT BOARD ESTIMATE OF
UNITED STATES OVER-ALL PRODUCTION
REQUIREMENTS.

III. PROBABLE CHARACTER OF THE ENEMY'S MAJOR STRATEGY:
(A) GERMAN STRATEGY: 16. c. (Cont'd)

the Black Sea. Success may depend upon whether or not a large concentration of British and Russian defensive forces are available, and upon the continued military capacity of Italy, now an uncertain quantity.

d. The occupation of Spain, Portugal, Morocco, French West Africa, Senegal, and the Atlantic Islands, for the purpose of strengthening the German offensive against British shipping, and for denying these positions to Germany's enemies. Considerable land, air, and naval forces will be required for this offensive, though not so great as would be required for conquest of the lands to the eastward of the Mediterranean.

17. In and near her own home territory, Germany can exert her full effort. As her forces move away from the home base, the effort that can be exerted at the point of military contact becomes reduced in proportion to the length and security of the lines of communication, and to the difficulties of transportation. Germany is experiencing these difficulties in Russia; she would experience them in an even greater degree in an offensive in the regions to the east of the Mediterranean; while the problem of the support of strong forces in Morocco, French West Africa, Senegal, and the Azores would be very great indeed. In the eastern part of European Russia, in Egypt, Irak, Iran, and North and West Africa, the effort that German military forces can exert is only a fraction of what they have been able to put forth in France, the Balkans, and Poland. Severe German defeats in these regions might readily affect the stability of the Nazi regime. This significant possibility should be taken into account in the development of the strategy of the Associated Powers.

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JOINT BOARD ESTIMATE OF
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REQUIREMENTS.

III. PROBABLE CHARACTER OF THE ENEMY'S MAJOR STRATEGY: (Cont'd)

(B) JAPANESE STRATEGY:

18. The Japanese objective is the establishment of the "East Asia Co-Prosperity Sphere". It is Japan's ambition ultimately to include within this Sphere Eastern Siberia, Eastern China, Indo-China, Thai, Malaya, the Netherlands East Indies, the Philippines, and possibly Burma. The accomplishment of this objective is a heavy task for Japan's strength, a fact well realized by the Japanese.

19. Dependent upon results in Europe, Japan's strategic moves might be as follows:

a. Building up and maintaining an effective screen in the Japanese Mandate Islands by the employment of minor naval forces and considerable air forces, supported by the COMBINED FLEET. This activity would include submarine and raider action against United States naval forces and United States and British lines of communication in the Central and Eastern Pacific Ocean.

b. The conquest of Eastern Siberia by means of land and air operations covered by the COMBINED FLEET operating to the eastward of Japan.

c. The conquest of Thai, Malaya, the Netherlands East Indies, and the Philippines. Success will require strong air forces, a considerable strength of light naval forces, and rather large land forces. It is unlikely that Japan will simultaneously attempt a major effort to the Northward and to the Southward, because of her lack of equipment and raw materials.

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JOINT BOARD ESTIMATE OF
UNITED STATES OVER-ALL PRODUCTION
REQUIREMENTS.

III. PROBABLE CHARACTER OF THE ENEMY'S MAJOR STRATEGY:
(B) JAPANESE STRATEGY: (19 - Cont'd)

d. An offensive from Northern Indo-China against Yunnan for the purpose of cutting the Burma Road and eliminating further resistance of the Chinese Nationalist army. This move might be supplemented by an attack on Burma. Considerable land and air forces would be required, as well as a large amount of shipping to provide the necessary support.

20. All of these prospective Japanese moves would be made at great distances from Japan. If Japan encounters stubborn and protracted resistance, her ability to continue offensives at these distances is problematical, owing to a lack of adequate resources and industrial facilities. Marked weakness or lack of cohesion on the part of her opponents might permit Japan to accomplish any one of these objectives within the next few months.

IV. MAJOR STRATEGY OF THE UNITED STATES AND ITS ASSOCIATES.

21. The Joint Board is convinced that the first major objective of the United States and its Associates ought to be the complete military defeat of Germany. If Germany were defeated, her entire European system would collapse, and it is probable that Japan could be forced to give up much of her territorial gains, unless she had already firmly established herself in such strength that the United States and its Associates could not afford the energy to continue the war against her.

22. An inconclusive peace between Germany and her present active military enemies would be likely to give Germany an opportunity to reorganize continental Europe and to replenish her strength. Even though the British Commonwealth and Russia were completely defeated, there would be important reasons for the United States to continue the war against Germany, in spite of the greatly increased difficulty of attaining final victory. From this it follows that

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JOINT BOARD ESTIMATE OF
UNITED STATES OVER-ALL PRODUCTION
REQUIREMENTS.

IV. MAJOR STRATEGY OF THE UNITED STATES AND ITS ASSOCIATES.
22. (Cont'd)

the principal strategic method employed by the United States in the immediate future should be the material support of present military operations against Germany, and their reinforcement by active participation in the war by the United States, while holding Japan in check pending future developments. Necessarily, only small Army contingents are now sufficiently equipped and trained for immediate participation in offensive operations.

23. Except in the case of Russia, the principal strength of the Associated Powers is in naval and air categories. Naval and air power may prevent wars from being lost, and by weakening enemy strength may greatly contribute to victory. By themselves, however, naval and air forces seldom, if ever, win important wars. It should be recognized as an almost invariable rule that only land armies can finally win wars.

24. It is out of the question to expect the United States and its Associates to undertake in the near future a sustained and successful land offensive against the center of the German power. It being obvious that the Associated Powers can not defeat Germany by defensive operations, effective strategic offensive methods other than an early land offensive in Europe must be employed. These methods may be found in a continuation of the economic blockade; the prosecution of land offensives in distant regions where German troops can exert only a fraction of their total strength; air and sea offensives against German military, economic and industrial resources; and the support of subversive activities in the conquered territories. Strategic methods to be employed against Japan (assuming her in the war) should be a strong defense of Siberia and Malaysia; an economic offensive through blockade; a reduction of Japanese military power by raids; and Chinese offensives against the Japanese forces of occupation.

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JOINT BOARD ESTIMATE OF
UNITED STATES OVER-ALL PRODUCTION
REQUIREMENTS.

IV. MAJOR STRATEGY OF THE UNITED STATES AND ITS ASSOCIATES. (Cont'd).

25. The major strategic objectives which it is believed the United States and the Associated Powers should adopt are indicated below, as well as the means for attaining them. The material assistance to be supplied friendly Powers (where mentioned in the succeeding subparagraphs), should be consistent with the needs of the United States.

a. The security of the Western Hemisphere against the extension into it of European or Asiatic political or military power is an essential of United States strategy. To provide this security under all eventualities, the United States must have naval, land, and air forces in such positions that they can be made promptly available in both the Atlantic and the Pacific Oceans in strengths adequate for preventing invasion should the British Isles and Russia collapse. In this connection, an important question is whether or not Northwestern Africa and the Atlantic Islands are in German or friendly hands. Similarly, Alaska, Hawaii, and the Islands of the South Pacific Ocean have an important relation to the security of the Eastern Pacific. United States naval strength, built up in accordance with the approved program, should be adequate for defensive needs until 1944. However, if Germany is successful in Europe, and Japan is successful in the Far East, naval strength for defensive purposes must be increased, even in excess of the present approved naval program. United States land and air forces may be required for the defense of the Western Hemisphere within the next few years, and it is necessary for Latin American countries to be provided with munitions and manufactured articles.

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JOINT BOARD ESTIMATE OF
UNITED STATES OVER-ALL PRODUCTION
REQUIREMENTS.

IV. MAJOR STRATEGY OF THE UNITED STATES AND ITS ASSOCIATES. (Cont'd) 25.

b. The security of the United Kingdom is essential to the prosecution in the Eastern Hemisphere of military operations against Germany and Japan. Its safety is also highly important to the defense of the Western Hemisphere. The security of the United Kingdom depends on an effective defense by sea, land, and air forces. In turn, this defense depends upon the safety of sea communications. The sea communications can continue to support the United Kingdom only if the damage now being inflicted upon them is greatly reduced through increases in the strength of the protective sea and air forces based in the British Islands, Iceland, and positions in the central and eastern Atlantic. Unless the losses of British merchant ships are greatly reduced, or unless there is an internal collapse of Germany, it is the opinion of the Joint Board that the resistance of the United Kingdom can not continue indefinitely, no matter what industrial effort is put forth by the United States. Therefore, the immediate and strong reinforcement of British forces in the Atlantic by United States naval and air contingents, supplemented by a large additional shipping tonnage, will be required if the United Kingdom is to remain in the war. These contingents must be manned by Americans, since the reserves of British manpower for employment in Europe are practically exhausted. To maintain present British strength, the United States must also continue to supplement the British blockade, and the naval building and repair potential; and to provide considerable numbers of aircraft.

c. Safety of the sea communications of the Associated Powers throughout the world is essential to the continuance of their war effort. Naval and air

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JOINT BOARD ESTIMATE OF
UNITED STATES OVER-ALL PRODUCTION
REQUIREMENTS.

IV. MAJOR STRATEGY OF THE UNITED STATES AND ITS ASSOCIATES. 25. c. (Cont'd)

forces employed in and near Europe should, so far as practicable, be strong enough to prevent the escape of surface raiders to the open sea, and to defeat submarine and air raiders. In addition, a widespread distribution of naval and air forces for direct protection of shipping foci and shipping routes will be required.

d. The enforcement of economic blockade is, for the time being, likely to be the most effective offensive method for use against Germany and Japan. Naval and air forces must be maintained to close all avenues of sea approach to Germany. The continued existence of hostile land fronts in Russia and in the Middle East is necessary if this blockade is to be maintained. In addition, diplomatic, economic, and financial measures should be employed for increasing the effectiveness of the military blockade.

e. The retention by the British of the control of the Red Sea, Irak, and Iran is necessary for preserving opportunities for decisive land action against Germany. Of great importance are effective land and air forces of all categories; large numbers of merchant vessels for their support; and adequate naval forces for the protection of communications leading to the Persian Gulf and the Red Sea. These forces can not be fully supported by the material means available to Britain. The United States should undertake to provide a part of the munitions and raw materials required by these troops, and should supply much of the merchant shipping for their transport.

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JOINT BOARD ESTIMATE OF
UNITED STATES OVER-ALL PRODUCTION
REQUIREMENTS.

IV. MAJOR STRATEGY OF THE UNITED STATES AND ITS ASSOCIATES. 25. (Cont'd)

f. The maintenance of an active front in Russia offers by far the best opportunity for a successful land offensive against Germany, because only Russia possesses adequate manpower, situated in favorable proximity to the center of German military power. For Russia, ground and aviation forces are most important. Predictions as to the result of the present conflict in Russia are premature. However, were the Soviet forces to be driven even beyond the Ural Mountains, and were they there to continue an organized resistance, there would always remain the hope of a final and complete defeat of Germany by land operations. The effective arming of Russian forces, both by the supply of munitions from the outside and by providing industrial capacity in the Volga Basin, or to the east of the Ural Mountains, would be one of the most important moves that could be made by the Associated Powers.

g. Prevention of Axis penetration into Northwest Africa and the Atlantic Islands is very important, not only as a contribution to the defense of the Western Hemisphere, but also as security to British sea communications and as a potential base for a future land offensive. In French North and West Africa, French troops exist which are potential enemies of Germany, provided they are re-equipped and satisfactory political conditions are established by the United States. Because the British Commonwealth has but few troops available and because of the unfriendly relations between the British and the Vichy regime, it seems clear that a large proportion of the troops of the Associated Powers employed in this region necessarily must be United States troops.

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JOINT BOARD ESTIMATE OF
UNITED STATES OVER-ALL PRODUCTION
REQUIREMENTS.

IV. MAJOR STRATEGY OF THE UNITED STATES AND ITS ASSOCIATES. 25. (Cont'd)

h. Retention by the United States and its Associates of the Philippines, Malaya, the Netherlands East Indies, Australasia, Burma, and China would have far-reaching effects. The armed forces of the United States can not be greatly increased in the Far East if they are to discharge their heavy tasks in other regions, but the operations of the Pacific Fleet will have an important influence on events. The United States should undertake to provide a part of the munitions and aircraft to China and the Netherlands East Indies. A large part of this material must be transported in United States bottoms.

i. Retention of Eastern Siberia by Russia is necessary if Japan is to be checked. Only material assistance can be provided by the United States to Siberia. No materials can be sent to Siberia by water when Japan is at war with Russia, but deliveries of aircraft could continue by air.

26. The following principles have been taken into consideration in arriving at recommendations concerning the strengths of the armed forces which the United States should undertake to raise or support, in whole or in part:

a. The Navy considers that, since the principal strength of the Associated Powers is at present in naval and air categories, the strategy which they should adopt should be based on the effective employment of those forces, and the employment of land forces in regions where Germany can not exert the full power of her land armies. The Army believes that the foregoing strategy may not accomplish the defeat of Germany and that it may be necessary to come to grips with the German armies on the continent of Europe. Consequently, the Army feels that the equipment for the land armies necessary to meet this contingency should be provided as a part of the over-all production requirements.

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JOINT BOARD ESTIMATE OF
UNITED STATES OVER-ALL PRODUCTION
REQUIREMENTS.

IV. MAJOR STRATEGY OF THE UNITED STATES AND ITS ASSOCIATES. 26. (Cont'd)

b. Past experience of the United States and other Powers should condition estimates of the capability of the United States to support a war effort, with due regard to differences in over-all industrial capacity; differences in availability of materials; and an appropriate balance between the man-power to be employed in the armed forces, and the man-power to be employed in industry and essential civilian services. Because of the present high degree of mechanization, a greater proportion of man-power must be allocated to industry for the manufacture of equipment and munitions than was the case in former wars.

c. The sound use of diplomatic, economic, financial, and propaganda weapons, will serve to reduce the magnitude of the direct military effort.

d. The burdens of the war effort, even though continued by the United States over a long period of time, should be so adjusted as to maintain the morale and the will to fight of the civilian population.

27. In Appendix I the Chief of Naval Operations presents his estimates of the over-all production required from the United States, by the dates indicated. These estimates pertain to the United States and foreign navies, and to the United States and foreign merchant marine fleets. The proposed size of the U.S. Navy is the so-called "Two-Ocean" Navy as approved by the President and Congress, plus a total tonnage increase of 21 per cent, plus the aircraft required for the indicated increase in aircraft-carrying naval vessels. The additional naval vessels recommended for the United States can be constructed without any increase in existing or approved ship-building and manufacturing facilities.

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JOINT BOARD ESTIMATE OF
UNITED STATES OVER-ALL PRODUCTION
REQUIREMENTS.

IV. MAJOR STRATEGY OF THE UNITED STATES AND ITS ASSOCIATES. (Cont'd)

28. In Appendix II the Chief of Staff presents estimated requirements for the United States and foreign armies, including aviation for forces other than United States naval aviation. The Chief of Staff believes that the equipment set up in the Army program should be assembled, if practicable from the viewpoint of industry, against the possible necessity of an all-out effort against Germany and her allies. The position of the Chief of Staff is that the maximum requirements of the Navy and Army, as related to tonnage and the probable conflicts in material, priority and production facilities, should be surveyed by OPM and then if necessary readjusted by the Joint Board within the limits determined by OPM.

George C. Marshall,
General, U.S. Army,
Chief of Staff.

H. R. Stark,
Admiral, U.S. Navy,
Chief of Naval
Operations.

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APPENDIX I. SECRET

DECISION ON PRODUCTION REQUIREMENTS FOR MAJOR CATEGORIES OF MATERIALS RECOMMENDED BY THE NAVY

(A) NAVY PROGRAM, for completion by December 31, 1946.

1. U.S. Navy, including aviation. Provide naval forces and facilities for the United States capable of executing strong naval offensives in the Eastern Atlantic and the Central and Western Pacific Oceans. Major items of this program are:

a. Naval Personnel, including that required for manning merchant auxiliary tonnage 1,100,000

b. Marine Corps Personnel 150,000

c. Naval vessels -

Type	Built	Building	Additional Required	Total
BB	15	17	0	32
CV	6	12	6	24
CB	0	6	4	10
CA	18	8	0	26
CL	19	40	16	75
DD	170	194	80	444
SS	112	72	54	238
Auxiliaries, large	183	95	100	378
Naval Coastal Frontier Forces	236	493	600	1329
Naval District Utility Craft	491	102	500	1093

Note: Additional auxiliary tonnage is included for estimate purposes in subparagraph (D) "Merchant Shipping Program".

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DECISION ON PRODUCTION REQUIREMENTS FOR MAJOR CATEGORIES OF MATERIALS RECOMMENDED BY THE NAVY.

(A) 1. (Cont'd)

d. Schedule of Naval Ship Deliveries.
Deliveries of large combatant naval vessels now under construction, authorized and proposed should be planned in accordance with this table:

	Jul-Dec 1941	1942	1943	1944	1945	1946
BB - Battleships	2	3	3	2	3	4
CV - Carriers	1	-	-	6	5	6
CB - Large Cruisers	-	-	-	-	6	4
CA - Heavy Cruisers	-	-	3	1	4	-
CL - Light Cruisers	1	7	14	17	8	9
DD - Destroyers	9	55	100	99	13	-
SS - Submarines	2	26	31	36	31	2

e. Naval Aircraft.

	Four Engined	Twin Engined	Single Engined	Total
Combatant aircraft assigned to tactical units	294	862	7,558	8,714
Combatant aircraft assigned as reserves and spares	147	431	7,558	8,136
Total Combatant Aircraft	441	1293	15,116	16,850
Training, Administrative and Miscellaneous	24	382	3,812	4,218
Total	465	1,675	18,928	21,068
Annual Replacement	600	1,400	16,500	18,000

Note: Overall replacement requirements, during war operations, and including active and inactive theaters, are estimated at approximately 100 per cent per year for combatant aircraft, and 40 per cent per year for all others.

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DECISION ON PRODUCTION REQUIREMENTS FOR MAJOR CATEGORIES OF MATERIALS RECOMMENDED BY THE NAVY.

(A) 1. (Cont'd)

f. Naval Shore Establishment.

See Appendix I and Appendix II for the permanent naval shore establishment program. To these total requirements should be added temporary overseas naval base constructions equivalent to 25% of the authorized permanent overseas construction. Emergency shipbuilding and manufacturing equivalents are to be computed under subparagraphs d, e, and g.

g. Naval Munitions Requirements for naval ships, aircraft and bases.

h. Marine Corps Munitions Requirements.

2. Foreign Navies. Provide Naval forces and facilities for Associated Powers as follows:

a. 300,000 tons of naval combatant vessels for the British Commonwealth.

b. 200,000 tons of naval combatant vessels for Latin-American countries.

c. Temporary facilities in the United States for the repair of 25% of British naval combatant vessels.

(B) ARMY PROGRAM, excluding aviation.

No estimates under this heading are submitted by the Navy.

(C) AVIATION PROGRAM, excluding U.S. Naval Aviation.

No estimates under this heading are submitted by the Navy.

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APPENDIX I.

DECISION ON PRODUCTION REQUIREMENTS FOR MAJOR CATEGORIES OF MATERIALS RECOMMENDED BY THE NAVY.

(D) MERCHANT SHIPPING PROGRAM, for completion by December 31, 1944.

1. Increase United States merchant shipping to a continuing total of 18,000,000 gross tons, including 600,000 gross tons for the U.S. Navy, additional to the present program. This merchant fleet is to be manned by the United States.

2. Supply the British Commonwealth with merchant shipping of a total of 6,000,000 gross tons.

Note: An analysis of shipping requirements is as follows:

a. For United States Industry and Latin-America, including sea-going and coastwise ships of over 1,000 gross tons	--	6,000,000 gross tons
b. For support of U.S. Army forces in Europe, Africa, and South America, estimated at 1,500,000 troops	--	2,400,000 " "
c. For transporting annually 12,000,000 tons of munitions for the support of Associated armed forces in Middle East, Russia and Asia, (estimated as the munitions requirements of 2,000,000 troops)	--	5,000,000 " "
d. For support of population, industry and armed forces in United Kingdom, (annual delivery of 15,000,000 tons)	--	4,000,000 " "
e. For transports for U.S. Navy for support of overseas naval forces and U.S. Army overseas garrisons	--	600,000 " "
Total required by 1944	--	18,000,000 " "
Loss of U.S. Flag vessels expected by 1944	--	3,000,000 " "

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DECISION ON PRODUCTION REQUIREMENTS FOR MAJOR CATEGORIES OF MATERIALS RECOMMENDED BY THE NAVY.

(D) 2. (Contid)

f. Ships to be supplied to the British Commonwealth by 1944 -- 6,000,000 gross tons

Thus the total tonnage that must be made available from United States sources by the end of 1944 is --27,000,000 " "

Of this there is now available --

g. U.S. Shipping -- 6,700,000 " "

h. Present merchant ship program due for completion in 1943 --10,700,000 " "

i. Total estimated as available by 1943 --17,400,000 " "

j. The additional program to meet requirements, and which should be built by the end of 1944 is -- 9,600,000 " "

Note: The Chairman of the Maritime Commission estimates this figure is the maximum that should be fixed for the United States shipbuilding industry.

(E) PROGRAM FOR CIVIL NEEDS OF THE UNITED STATES.

Fabricated, processed, and raw materials, required by the population of the United States for civil purposes. (Requirements for this need should be established by other than military agencies.)

(F) PROGRAM FOR CIVIL NEEDS OF FRIENDLY POWERS.

Fabricated, processed, and raw materials, required from the United States for the industrial and civil establishments of friendly Powers. Attention should be given to the importance of establishing

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APPENDIX I.

DECISION ON PRODUCTION REQUIREMENTS FOR MAJOR CATEGORIES OF MATERIALS RECOMMENDED BY THE NAVY.

(F) (Cont'd)

raw material and industrial production facilities outside of the United States, in regions where the following conditions exist:

1. Raw materials are available, or their production is readily possible.

2. Man-power is available for industrial employment.

3. Proximity to a hostile front, with ample man-power available for military employment. (Requirements for this need should be established by civil agencies, in consultation with military authorities).

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Brief of Strategic Concept of Operations Required to Defeat our Potential Enemies

(September 1941)

Strategic Objective: To defeat GERMANY and her Allies.

Purpose of the formulation of a Strategic Concept of Operations: To evolve a basis for the determination of the United States over-all production requirements.

ASSUMPTIONS

1. U.S. National Policy is:

a. Monroe Doctrine: Resist with all means Axis penetration in Western Hemisphere.
b. Aid to Britain: Limited only by U.S. needs and abilities of British to utilize; insure delivery.
c. Aid to other Axis-opposed nations: Limited by U.S. and British requirements.
d. Far-Eastern policy: To disapprove strongly Japanese aggression and to convey to Japan determination of U.S. to take positive action. To avoid major military and naval commitments in the Far East at this time.
e. Freedom of the Seas.

2. That eventually the U.S. will employ all armed forces necessary to accomplish national objectives.

3. That potential enemies are Germany, Italy, Japan, Bulgaria, Roumania, Vichy France, and Axis-controlled or occupied nations.

4. That our potential associates and friendly powers are the British Commonwealth, China, Russia, Free French, Latin American Countries, Governments in Exile, Netherlands East Indies and Turkey.

5. That the principal theater of operations is Europe, but other possible theaters may later appear desirable.

6. That operations will be in accordance with approved secret war plans.

7. That the defeat of our potential enemies is primarily dependent on the defeat of GERMANY.

8. That field forces (air and/or ground) will not be prepared for ultimate decisive modern combat before July 1, 1943 due to shortage of essential equipment.

9. That the strategic concept, based upon the implementation provided by the ultimate program, must be projected to the period subsequent to July 1, 1943.

10. That ultimate requirements, based on association with British Empire, will more than cover the quantitative requirements of the United States in case of British defeat. Qualitative changes in the production of certain articles will be necessary.

11. That the paramount territorial interests of the United States are in the Western Hemisphere, and that the United States must maintain dispositions to prevent the extension of European or Asiatic political or military power in the Western Hemisphere.

1st Phase - (Until M-Day, or when hostilities begin)

Objective: Insure delivery of supplies to the British Isles and provide munitions for other nations fighting the Axis, in order to preclude a diminution of their war effort and concurrently to prepare U.S. forces for active participation in the war.

Nature of Operations:
Continue to carry out present national policies, short of war.
Continue the training and equipping of armed forces.
Reinforce Atlantic bases, Alaska, and overseas garrisons.
Relieve British troops in Iceland.
Continue naval operations as provided in approved secret war plans.
Continue joint training exercises to greatest possible extent.
Establish South American bases as soon as diplomatic arrangements are consummated.
Initiate at once the production program for the provision of ultimate requirements of armed forces and the necessary shipping for the armed forces.
To insure that the maximum number of troops are available to assist in the expansion program, the Secretary of War will determine from time to time the size, composition and projected employment of units deemed necessary for an emergency striking force. This fully equipped and highly trained force will be maintained to meet any emergency and the combat effectiveness of units in such force must not be jeopardized in the expansion of the Army. All other units and equipment not required in emergency striking forces will be available for the training of new increments.

2d Phase (M-Day until prepared for final offensive action)

Objective: Prepare the way for eventual defeat of Germany by active participation as Associate of Great Britain and other nations fighting the Axis Powers.

Nature of Operations: In general, a strategic defensive in all theatres.
Prevent Axis penetration into Western Hemisphere by destroying enemy expeditionary forces and by denying use of bases.
Protect sea communications of Associated Powers and destroy Axis sea communications.
Defend continental U.S., bases, and overseas possessions.
Destroy Axis sea power.
Continue aid to Britain to keep her full man power equipped as to air and ground forces.
Destroy Axis communications, production facilities, and air forces by cooperation of U.S. air units with R.A.F. Intensify Air Force Program to insure early air superiority.
Defend U.S. naval and air bases wherever located.
Provide token force for defense of British Isles.
In the Far East, defend Philippines, and support forces of Associated Powers in accordance with approved secret war plans.
Take all necessary measures to inforce economic blockade of Axis Powers.
Continue to build up well-trained, modernly equipped military forces in the United States for eventual employment in decisive action against the Axis Powers.
Establish additional, strategically located sea and air bases to facilitate operations during this and the final phase.

Final Phase

Objective: Total defeat of Germany.

Nature of Operations: Strategic offensive in Atlantic and European Theatres; strategic defensive in Far East.
Continue operations of Phase 2, greatly intensified.
Gain air superiority in Europe by conducting vigorous air operations, utilizing to the maximum the air base facilities in the British Isles.
Maintain sufficient reserves of land and air forces with necessary shipping to apply pressure upon Germany wherever soft spots arise in Europe or adjacent areas; to seize air bases wherever opportunity offers; and to provide the final decisive task forces for offensive action in any appropriate overseas theatre.
Prior to the final offensive, the following conditions must be created:
(1) Axis surface and sub-surface vessels swept from the Atlantic and North Sea or their operations rendered ineffective in those waters.
(2) Axis air operations greatly restricted by active offensive action and passive economic deprivation.
(3) Support to Axis totalitarian governments weakened by subversive activities, prolongation of war, suffering caused by economic blockade.
(4) The effectiveness of the German combat team has been weakened by over-extension, air attack on production and communication facilities, and deprivation of essential supplies.

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(PART I - APPENDIX II)

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...tegic Concept of Operations Required to Defeat our Potential Enemies

(September 1941)

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...Operations: To evolve a basis for the determination of the United States over-all production requirements.

...when hostilities

...of supplies to ...vide munitions for ... Axis, in order ...of their war ef- ...prepare U.S. forces ...in the war.

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...an bases as soon ...s are consummated. ...roduction program ...ate requirements ...ecessary shipping

...imum number of troops ...n the expansion pro- ...r will determine from ...position and pro- ...s deemed necessary for ...ce. This fully ...ed force will be ...ergency and the combat ... such force must not ...ansion of the Army. ...ment not required in ... will be available ...increments.

2d Phase (M-Day until prepared for final offensive action)

Objective: Prepare the way for eventual defeat of Germany by active participation as Associate of Great Britain and other nations fighting the Axis Powers.

Nature of Operations: In general, a strategic defensive in all theatres.

Prevent Axis penetration into Western Hemisphere by destroying enemy expeditionary forces and by denying use of bases.

Protect sea communications of Associated Powers and destroy Axis sea communications.

Defend continental U.S., bases, and overseas possessions.

Destroy Axis sea power.

Continue aid to Britain to keep her full man power equipped as to air and ground forces.

Destroy Axis communications, production facilities, and air forces by cooperation of U.S. air units with R.A.F. Intensify Air Force Program to insure early air superiority.

Defend U.S. naval and air bases wherever located.

Provide token force for defense of British Isles.

In the Far East, defend Philippines, and support forces of Associated Powers in accordance with approved secret war plans.

Take all necessary measures to inforce economic blockade of Axis Powers.

Continue to build up well-trained, modernly equipped military forces in the United States for eventual employment in decisive action against the Axis Powers.

Establish additional, strategically located sea and air bases to facilitate operations during this and the final phase.

Final Phase

Objective: Total defeat of Germany.

Nature of Operations: Strategic offensive in Atlantic and European Theatres; strategic defensive in Far East.

Continue operations of Phase 2, greatly intensified.

Gain air superiority in Europe by conducting vigorous air operations, utilizing to the maximum the air base facilities in the British Isles.

Maintain sufficient reserves of land and air force with necessary shipping to apply pressure upon Germany wherever soft spots arise in Europe or adjacent areas; to seize air bases wherever opportunity offers; and to provide the final decisive task forces for offensive action in any appropriate overseas theatre.

Prior to the final offensive, the following conditions must be created:

(1) Axis surface and sub-surface vessels swept from the Atlantic and North Sea or their operations rendered ineffective in those waters.

(2) Axis air operations greatly restricted by active offensive action and passive economic deprivation.

(3) Support to Axis totalitarian governments weakened by subversive activities, prolongation of war, suffering caused by economic blockade.

(4) The effectiveness of the German combat team has been weakened by over-extension, air attack on production and communication facilities, and deprivation of essential supplies.

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(PART I - APPENDIX II)

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ULTIMATE REQUIREMENTS - GROUND FORCES

(September 1941)

ASSUMPTIONS

I. That the world situation as of July 1, 1943 will be approximately as follows:

1. Russia is considerably weakened militarily in Europe. Resistance in Siberia, to include Maritime Provinces, continuing.

2. The Axis military strength is materially weakened through economic blockade; by losses in the Russian campaign; by British air and sea operations; by the inability to exploit quickly the extensively sabotaged Russian industries and raw materials; by lowered morale of the people.

3. The military forces of Japan are fully involved with or contained by campaigns against a somewhat strengthened China, by the Russian forces in the Far East Maritime Provinces, or by the threat of United States - British military and economic reprisals.

4. Great Britain and associates have increased their fighting forces by creating and equipping additional combat units.

5. The French continue their passive collaboration with Germany.

6. Control of the Mediterranean Theater, including North Africa and the Near East, remains disputed.

7. The United States is an active belligerent and is collaborating, militarily and economically with Great Britain and associates in an all-out effort to defeat Germany.

II. That before ground operations are undertaken in Continental Europe, the following conditions must be created by our sea and air forces in collaboration with the British and Associated Powers:

1. The surface and subsurface vessels of the Axis must be swept from the seas, particularly in the Atlantic and water areas contiguous to Europe.

2. Overwhelming air superiority must be accomplished.

3. The economic and industrial life of Germany must be rendered ineffective through the disruption and destruction of lines of communications, of port and industrial facilities, and by the interception of raw materials.

4. The combat effectiveness of the German air and ground units must be weakened by overextension, dispersion, and shortage of materiel, including fuel.

5. Popular support of the war effort by the peoples of the Axis Powers must be weakened and their confidence shattered by subversive activities, propaganda, deprivation and the destruction wrought.

III. That the scope and nature of the military operations necessary to defeat the Axis Powers cannot be predicted at this time, but we must prepare to fight Germany by actually coming to grips with and defeating her ground forces and definitely breaking her will to combat.

IV. That the establishment of effective military bases, encircling the Nazi citadel, must be undertaken as appropriate means become available and when favorable conditions are created for the operations involved.

ULTIMATE GOAL - GROUND FORCES

I. Based on the foregoing assumptions, and on the military operations deemed necessary for the realization of our national objectives, a production capacity must be created to accomplish the following:

1. To assist Great Britain, China, Russia and other associates in order to preclude a diminution of their war effort.

2. To provide the shipping required in order to sustain an all-out military effort, and concurrently, to provide for our commercial needs and to assist friendly Powers.

3. To equip and maintain forces for employment in Military Bases, Outlying Possessions, and Potential Task Forces as follows:

a. MILITARY BASES AND OUTLYING POSSESSIONS

Newfoundland	5,690
Greenland	2,531
Jamaica	876
Bermuda	3,741
Antigua	434
St. Lucia	434
Curacao - Aruba	5,951
British Guiana	362
Trinidad	28,411
Puerto Rico	34,767
Panama	42,614
Hawaii	61,337
Philippines	25,397
Alaska	28,823
Iceland	28,709
Scotland	10,147
Ireland	24,656
England	41,357
Total	346,217

b. POTENTIAL TASK FORCES

Brazil

1 Army Corps (Hq & Hq Co and Corps Troops)	17,147
1 Infantry Triangular Division	15,245
1 Air-Borne Division	10,000
2 Artillery Battalions (75mm How Pk)	1,804
1 Cavalry Regiment (H-M)	1,591
5 Parachute Battalions	2,590
1 Antiaircraft Regiment	1,925
2 Antiaircraft Battalions, 37mm (Mobile)	1,694
2 Aircraft Warning Regiments	2,600
2 Tank Battalions (Light)	1,086
3 Antitank Battalions (Gun)	2,100
Services (Med, Ord, QM, Engr, Sig)	28,864
Total	86,646

Colombia-Ecuador-Peru

1 Infantry Triangular Division	15,245
2 Artillery Battalions (105mm)	1,400
3 Parachute Battalions	1,554
1 Antiaircraft Regiment	1,925
2 Antiaircraft Battalions, 37mm (Mobile)	1,694
2 Tank Battalions (Light)	1,086
1 Aircraft Warning Regiment	1,300
Services (Med, Ord, QM, Engr, Sig)	13,035
Total	37,239

First Army

1 Army (Hq & Hq Co and Army Troops)	53,570
3 Army Corps Hq & Hq Co. and Corps Troops	51,441
9 Infantry Triangular Divisions	137,205
2 Armored Corps Hq and Corps Troops	2,768
4 Armored Divisions	50,788
4 Infantry Triangular Divisions (Mtzd)	64,516
6 Artillery Battalions (105mm)	4,200
2 Artillery Regiments (Heavy)	3,000
3 Artillery Battalions (75mm How Pk)	2,706
2 Mountain Divisions	24,000
2 Air-Borne Divisions	20,000
5 Parachute Battalions	2,590
20 Antiaircraft Regiments	38,500
10 Antiaircraft Battalions 37mm (Mobile)	8,470
3 Tank Battalions (Medium)	2,124
5 Tank Battalions (Light)	2,715
12 Aircraft Warning Regiments	15,600
10 Tank Destroyer Battalions	7,000
10 Antitank Battalions (Gun)	7,000
Services (Ord, QM, Sig, Engr, Med)	278,069
Total	776,262

Third Army

1 Army Hq & Hq Co and Army Troops	53,570
3 Army Corps Hq & Hq Co and Corps Troops	51,441
9 Infantry Triangular Divisions	137,205
1 Armored Corps Hq and Corps Troops	1,384
2 Armored Divisions	25,394
2 Infantry Triangular Divisions (Mtzd)	32,258
4 Artillery Battalions (105mm)	2,800
1 Artillery Regiment (Heavy)	1,500
1 Cavalry Corps Hq and Corps Troops	333
2 Cavalry Divisions	23,352
2 Cavalry Regiments (H-M)	3,182
2 Air-Borne Divisions	20,000
5 Parachute Battalions	2,590
5 Antiaircraft Regiments	9,625
3 Antiaircraft Battalions 37mm (Mobile)	2,541
3 Aircraft Warning Regiments	3,900
5 Tank Destroyer Battalions	3,500
10 Antitank Battalions (Gun)	7,000
Services (Med, Ord, QM, Engr, Sig)	207,860
Total	589,435

Fourth Army

1 Army Hq & Hq Co and Army Troops	53,570
3 Army Corps Hq & Hq Co and Corps Troops	51,441
9 Infantry Triangular Divisions	137,205
2 Armored Divisions	25,394
4 Infantry Triangular Divisions (Mtzd)	64,516
4 Artillery Battalions (105mm)	2,800
4 Artillery Regiments (Heavy)	6,000
2 Mountain Divisions	24,000
2 Air-Borne Divisions	20,000
2 Parachute Battalions	1,036
15 Antiaircraft Regiments	28,875
10 Antiaircraft Battalions 37mm (Mobile)	8,470
3 Tank Battalions (Medium)	2,124
5 Tank Battalions (Light)	2,715
6 Aircraft Warning Regiments	7,800
10 Tank Destroyer Battalions	7,000
15 Antitank Battalions (Gun)	10,500
Services (Med, Ord, QM, Engr, Sig)	266,413
Total	709,859

Total Potential Task Forces 2,199,441

4. The total number of troops considered necessary the ground forces, i.e. organized, fully equipped and tr for current and future employment as security forces in bases and carrying possessions, and as striking forces i theater, follow:

Bases and Outlying Possessions	
Potential Task Forces	
Total	

5. Production capacity should be created to equip approximately 3 million additional men in the reserve po indicated below. Activation, location, and training of units will depend upon the international situation.

Strategic Reserves

2 Army Hq & Hq Cos, and Army Troops	
10 Army Corps Hq & Hq Cos, and Corps Troops	
27 Infantry Triangular Divisions	
14 Armored Corps Hq & Hq Cos, and Corps Troops	
53 Armored Divisions	
51 Infantry Triangular Divisions (Mtzd)	
24 Artillery Regiments (Heavy)	
15 Artillery Battalions (75mm Pack)	
52 Artillery Battalions (105mm)	
2 Cavalry Divisions	
6 Mountain Divisions	
3 Air-Borne Divisions	
22 Parachute Battalions	
129 Antiaircraft Regiments	
133 Antiaircraft Battalions, 37mm (Mobile)	
70 Tank Battalions (Medium)	
6 Tank Battalions (Light)	
10 Tank Battalions (Heavy)	
29 Aircraft Warning Regiments	
290 Tank Destroyer Battalions	
262 Antitank Battalions (Gun)	
Total (approximately)	3,

6. The Army Aviation Program is included in a separ which indicates the detailed organization and requirement essential equipment.

Total Air Force Personnel (Zone of Interior Troops excluded)	1,

7. Zone of Interior and Fixed Defense Units

Army Ground Forces	1,
Army Air Force	
Total	2,

8. Recapitulation

a. Army Ground Force

Military Bases and Outlying Possessions	
Potential Task Forces	2,
Zone of Interior and Fixed Defense (Ground)	1,
Total Ground Forces (Activated)	3,
Reserve Pool (activated as situation requires)	1,
Total of all Ground Units	6,

b. Army Air Force

Combat Units	1,
Zone of Interior and Service Units	
Total Air Force	2,

c. Grand Total

Army Ground Units	6,
Army Air Units	2,
Total Army Forces	8,

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ULTIMATE REQUIREMENTS - GROUND FORCES

(September 1941)

ULTIMATE GOAL - GROUND FORCES

1. Based on the foregoing assumptions, and on the military operations deemed necessary for the realization of our national objectives, a production capacity must be created to accomplish the following:

1. To assist Great Britain, China, Russia and other associates in order to preclude a diminution of their war effort.

2. To provide the shipping required in order to sustain an all-out military effort, and concurrently, to provide for our commercial needs and to assist friendly Powers.

3. To equip and maintain forces for employment in Military Bases, Outlying Possessions, and Potential Task Forces as follows:

a. MILITARY BASES AND OUTLYING POSSESSIONS

Newfoundland	5,690
Greenland	2,531
Jamaica	876
Bermuda	3,741
Antigua	434
St. Lucia	434
Curacao - Aruba	5,961
British Guiana	352
Trinidad	28,411
Puerto Rico	34,757
Panama	47,614
Hawaii	61,337
Philippines	25,397
Alaska	28,823
Iceland	28,709
Scotland	10,147
Ireland	24,656
England	41,357
Total	346,217

b. POTENTIAL TASK FORCES

Brazil

1 Army Corps (Hq & Hq Co and Corps Troops)	17,147
1 Infantry Triangular Division	15,246
1 Air-Borne Division	10,000
2 Artillery Battalions (75mm How Pk)	1,804
1 Cavalry Regiment (H-M)	1,591
5 Parachute Battalions	2,590
1 Antiaircraft Regiment	1,925
2 Antiaircraft Battalions, 37mm (Mobile)	1,694
2 Aircraft Warning Regiments	2,600
2 Tank Battalions (Light)	1,086
3 Antitank Battalions (Gun)	2,100
Services (Med, Ord, QM, Engr, Sig)	28,864
Total	86,646

Colombia-Ecuador-Peru

1 Infantry Triangular Division	15,246
2 Artillery Battalions (105mm)	1,400
3 Parachute Battalions	1,554
1 Antiaircraft Regiment	1,925
2 Antiaircraft Battalions, 37mm (Mobile)	1,694
2 Tank Battalions (Light)	1,086
1 Aircraft Warning Regiment	1,300
Services (Med, Ord, QM, Engr, Sig)	11,034
Total	37,239

First Army

1 Army (Hq & Hq Co and Army Troops)	53,570
3 Army Corps Hq & Hq Co, and Corps Troops	51,441
9 Infantry Triangular Divisions	137,205
2 Armored Corps Hq and Corps Troops	2,768
4 Armored Divisions	50,788
4 Infantry Triangular Divisions (Mtzd)	64,516
9 Artillery Battalions (105mm)	4,200
2 Artillery Regiments (Heavy)	3,000
3 Artillery Battalions (75mm How Pk)	2,706
2 Mountain Divisions	24,000
2 Air-Borne Divisions	20,000
5 Parachute Battalions	2,590
20 Antiaircraft Regiments	38,500
10 Antiaircraft Battalions 37mm (Mobile)	8,470
3 Tank Battalions (Medium)	2,124
5 Tank Battalions (Light)	2,715
12 Aircraft Warning Regiments	15,600
10 Tank Destroyer Battalions	7,000
10 Antitank Battalions (Gun)	7,000
Services (Ord, QM, Sig, Engr, Med)	278,098
Total	776,282

Third Army

1 Army Hq & Hq Co and Army Troops	53,570
3 Army Corps Hq & Hq Co and Corps Troops	51,441
9 Infantry Triangular Divisions	137,205
1 Armored Corps Hq and Corps Troops	1,384
2 Armored Divisions	25,394
2 Infantry Triangular Divisions (Mtzd)	32,258
4 Artillery Battalions (105mm)	2,800
1 Artillery Regiment (Heavy)	1,500
1 Cavalry Corps Hq and Corps Troops	333
2 Cavalry Divisions	23,352
2 Cavalry Regiments (H-M)	3,182
2 Air-Borne Divisions	20,000
5 Parachute Battalions	2,590
5 Antiaircraft Regiments	9,625
3 Antiaircraft Battalions 37mm (Mobile)	2,541
3 Aircraft Warning Regiments	3,900
5 Tank Destroyer Battalions	3,500
10 Antitank Battalions (Gun)	7,000
Services (Med, Ord, QM, Engr, Sig)	207,860
Total	589,435

Fourth Army

1 Army Hq & Hq Co and Army Troops	53,570
3 Army Corps Hq & Hq Co and Corps Troops	51,441
9 Infantry Triangular Divisions	137,205
2 Armored Divisions	25,394
4 Infantry Triangular Divisions (Mtzd)	64,516
4 Artillery Battalions (105mm)	2,800
4 Artillery Regiments (Heavy)	6,000
2 Mountain Divisions	24,000
2 Air-Borne Divisions	20,000
2 Parachute Battalions	1,036
15 Antiaircraft Regiments	28,875
10 Antiaircraft Battalions 37mm (Mobile)	8,470
3 Tank Battalions (Medium)	2,124
5 Tank Battalions (Light)	2,715
6 Aircraft Warning Regiments	7,800
10 Tank Destroyer Battalions	7,000
15 Antitank Battalions (Gun)	10,500
Services (Med, Ord, QM, Engr, Sig)	256,413
Total	709,859

Total Potential Task Forces 2,199,441

c. The total number of troops considered necessary in the ground forces, i.e. organized, fully equipped and trained, for current and future employment as security forces in military bases and outlying possessions, and as striking forces in any theater, follow:

Bases and Outlying Possessions	346,217
Potential Task Forces	2,199,441
Total	2,545,658

5. Production capacity should be created to equip approximately 4 million additional men in the reserve pool indicated below. Activation, location, and training of these units will depend upon the international situation.

Strategic Reserves

2 Army Hq & Hq Cos, and Army Troops	
10 Army Corps Hq & Hq Cos, and Corps Troops	
27 Infantry Triangular Divisions	
14 Armored Corps Hq & Hq Cos, and Corps Troops	
53 Armored Divisions	
51 Infantry Triangular Divisions (Mtzd)	
24 Artillery Regiments (Heavy)	
15 Artillery Battalions (75mm Pack)	
52 Artillery Battalions (105mm)	
2 Cavalry Divisions	
6 Mountain Divisions	
3 Air-Borne Divisions	
22 Parachute Battalions	
129 Antiaircraft Regiments	
133 Antiaircraft Battalions, 37mm (Mobile)	
70 Tank Battalions (Medium)	
6 Tank Battalions (Light)	
10 Tank Battalions (Heavy)	
29 Aircraft Warning Regiments	
290 Tank Destroyer Battalions	
262 Antitank Battalions (Gun)	
Total (approximately)	3,000,000

6. The Army Aviation Program is included in a separate study, which indicates the detailed organization and requirements in essential equipment.

Total Air Force Personnel (Zone of Interior Troops excluded)	1,100,000

7. Zone of Interior and Fixed Defense Units

Army Ground Forces	1,200,000
Army Air Force	950,000
Total	2,150,000

8. Recapitulation

a. Army Ground Force

Military Bases and Outlying Possessions	346,217
Potential Task Forces	2,199,441
Zone of Interior and Fixed Defense (Ground)	1,200,000
Total Ground Forces (Activated)	3,745,658
Reserve Pool (activated as situation requires)	3,000,000
Total of all Ground Units	6,745,658

b. Army Air Force

Combat Units	1,100,000
Zone of Interior and Service Units	950,000
Total Air Force	2,050,000

c. Grand Total

Army Ground Units	6,745,658
Army Air Units	2,050,000
Total Army Forces	8,795,658

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ESTIMATE

ARMY REQUIREMENTS
SUPPORTING STUDY
prepared by:

WAR PLANS DIVISION
GENERAL STAFF

(SECTION II, PART II, APPENDIX II).

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ULTIMATE REQUIREMENTS STUDY

ESTIMATE OF ARMY GROUND FORCES

1. The specific operations necessary to accomplish the defeat of the Axis Powers cannot be predicted at this time. Irrespective of the nature and scope of these operations, we must prepare to fight Germany by actually coming to grips with and defeating her ground forces and definitely breaking her will to combat. Such requirement establishes the necessity for powerful ground elements, flexibly organized into task forces which are equipped and trained to do their respective jobs. The Germans and their associates with between 11 and 12 million men under arms, now have approximately 300 divisions fully equipped and splendidly trained. It is estimated that they can have by 1943, a total of 400 divisions available in the European Theater.

2. The important influence of the air arm in modern combat has been irrefutably established. The degree of success attained by sea and ground forces will be determined by the effective and timely employment of air supporting units and the successful conduct of strategical missions. No major military operation in any theater will succeed without air superiority, or at least air superiority disputed. The necessity for a strong sea force, consisting principally of fast cruisers, destroyers, aircraft carriers, torpedo boats and submarines, continues in spite of the increased fighting potential of the air arm. Employment of enemy air units has not yet deprived naval vessels of their vital role on the high seas, but has greatly accelerated methods and changed the technique in their employment. It appears that the success of naval operations, assuming air support, will still be determined by sound strategic concepts and adroit leadership. A sea blockade will not accomplish an economic strangulation or

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or military defeat of Germany. Nor will air operations alone bring victory. Air and sea forces will make important contributions but effective and adequate ground forces must be available to close with and destroy the enemy within his citadel.

3. It is therefore imperative that we create the productive capacity to provide equipment for the following:

a. Appropriate forces distributed for the defense of the United States, outlying possessions and bases selected to facilitate the defense of the country and the Western Hemisphere.

b. Task Forces which can effectively conduct military operations, primarily in the European Theater, as well as in the Western Hemisphere and in other strategically important areas.

c. The military forces of associates and friendly Powers committed to the policy of opposing Nazi aggression. Quantities to be limited only by our own strategic requirements and the ability of the friendly Powers to use the equipment effectively.

4. A sound approach to the problem of determining appropriate military forces requires careful consideration of WHERE, HOW and WHEN, they will be employed to defeat our potential enemies and to assist our associates.

a. WHERE. Accepting the premise, that we must come to grips with the enemy ground forces, our principal theater of war is Central Europe. Possible subsidiary theaters include Africa, the Near East, the Iberian Peninsula, the Scandinavian Peninsula and the Far East; however, the operations in these theaters must be so conducted as to facilitate the decisive employment of Allied forces in Central Europe.

b. HOW. The combined and carefully coordinated operations of our military forces, in collaboration with associated Powers, must accomplish the following:

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(1) The surface and subsurface vessels of the Axis and associated Powers must be swept from the seas, particularly in the Atlantic and water areas contiguous to Europe.

(2) Overwhelming air superiority must be accomplished.

(3) The economic and industrial life of Germany must be rendered ineffective through the continuous disruption and destruction of lines of communication, ports and industrial facilities, and by the interception of raw materials.

(4) The combat effectiveness of the German military forces must be greatly reduced by over-extension, dispersion, shortage of material, including fuel, and a deterioriation of the Home Front. Popular support of the war effort, by the peoples of the Axis Powers must be weakened and their confidence shattered by subversive activities, propaganda, deprivation, the destruction wrought and chaos created.

(5) Existing military bases (the British Isles and the Near East) must be maintained. Additional bases, which encircle and close in on the Nazi citadel, must be established in order to facilitate air operations designed to shatter the German industrial and economic life. Such bases may also provide feasible points of departure for the combined operations of ground and air forces. In disposing of our forces, we must guard against dispersion of means in operations that do not make timely and effective contributions to the accomplishment of our main task, the defeat of Germany.

(6) The commitment of our forces must conform to our accepted broad strategic concept of active (offensive) operations in one theater (European), and concurrently, passive (defensive) operations in the other (Pacific).

3. TIME. The following factors with regard to the time element are important in determining the production capacity necessary to realize our national objectives:

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(1) The lag between plan and execution is considerable. Past experience indicates that from eighteen months to two years are required.

(2) How many months will Germany require to defeat Russia, to reconstitute her forces subsequent to Russia's defeat and to exploit to any perceptible degree the vast resources of Russia? It is believed that Germany will occupy Russian territory west of the general line; White Sea, Moscow, Volga River, (all inclusive) by July 1, 1943, and that militarily, Russia will be substantially impotent subsequent to that date. Thereafter, Germany will "Coventry" all industrial areas, lines of communications and sources of raw materials east of the line indicated, unless a drastic Nazi treaty is accepted by Russia. Germany will probably require a full year to bring order out of chaos in the conquered areas, so that it will be July 1, 1943, before she will largely profit economically by her "drive to the east." The maintenance of huge armies of occupation has become unnecessary. By totally disarming the conquered people, maintaining splendidly organized intelligence and communications nets, and employing strategically located, highly mobile forces (parachute, air-borne, mechanized and motorized), Germany may control the occupied areas with relatively small forces, thus releasing the bulk of the military for other tasks. Obviously, our war effort time-table, covering the production of munitions, the creation of trained military forces and the increase of transportation facilities (air, ground and sea), is strongly influenced by events transpiring in the Russian theater.

(3) We are confronted by two possibilities; first, a rapidly accelerated all-out effort with a view to conducting decisive, offensive operations against the enemy before he can liquidate or recoup from his struggle with Russia; second, a long drawn-out war of

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attrition. Under our present production schedule, we will soon have adequate military means to defend our outlying possessions and bases and to provide for the security of the Western Hemisphere, but we will not be able to provide sufficient appropriate forces for timely offensive action in the principal theater of operations. The urgency for positive action exists, particularly while the enemy is contained militarily in Russia. It would strongly contribute to the early and decisive defeat of the Axis Powers, if the Allied forces could seize and firmly establish military bases from which immediate air and subsequent ground and air operations might be undertaken.

(4) The United States is approaching its task in a logical manner, but the production of material must be greatly accelerated to permit its accomplishment. At present, the bulk of our production has to be devoted to the support of Great Britain and associates, rendering it impracticable for us to undertake offensive commitments. But time is of the essence and the longer we delay effective offensive operations against the Axis, the more difficult will become the attainment of victory. It is mandatory that we reach an early appreciation of our stupendous task, and gain the whole-hearted support of the entire country in the production of trained men, ships, munitions, and ample reserves. Otherwise, we will be confronted in the not distant future by a Germany strongly entrenched economically, supported by newly acquired sources of vital supplies and industries, with her military forces operating on interior lines, and in a position of hegemony in Europe which will be comparatively easy to defend and maintain.

(5) The time by which production can reach the levels defined by our national objectives is highly speculative. July 1, 1943, has been established as the earliest date on which the

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equipment necessary to initiate and sustain our projected operations can be provided. The ability of industry to meet this requirement is contingent upon many intangibles; however, the program can be definitely accomplished, in fact, greatly exceeded, if the industrial potential of the country is fully exploited. The urgency of speed and the desirability of employing our present great economic and industrial advantage over our potential enemies cannot be overemphasized.

4. Strategic Employment of Ground Forces.

a. The future alignment of Powers and their respective combat capacities cannot be accurately predicted. In order to arrive at a plausible basis from which to determine our future requirements, the following assumptions pertaining to the world situation as of July 1, 1942, are made:

(1) Russia is substantially impotent militarily in Europe. Resistance in Siberia, to include the Maritime Provinces, probably continues.

(2) The Axis military strength is materially weakened through economic blockade; by losses in the Russian campaign, by British air and sea operations; by the inability to exploit quickly the extensively sabotaged Russian industries and raw materials; by lowered morale of the people.

(3) The military forces of Japan are fully involved with or contained by campaigns against a somewhat strengthened China, by the Russian forces in the Far East Maritime Provinces, or by the threat of United States - British military and economic reprisals.

(4) Great Britain and associates have increased their fighting forces by creating and equipping additional combat units.

(5) The French will probably continue their passive collaboration with Germany.

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(6) Control of the Mediterranean Theater, including North Africa and the Near East, remains disputed.

(7) The United States is an active belligerent and is collaborating in an all-out effort to defeat Germany.

b. If these assumptions are correct, or even reasonably sound, on July 1, 1943, there will be no military bases remaining in Allied hands, other than the United Kingdom, possibly the northern coast of Africa and the Near East. The establishment of additional bases, for example, in the Iberian Peninsula, the Scandinavian Peninsula and Northwest Africa, will be bitterly contested by the Axis. However, to bring about the ultimate defeat of Germany, those bases and others even more difficult to establish, must be available to the Allies. Obviously, carefully planned action, involving appropriate sea, air and ground units must be undertaken. Allied success is directly contingent upon the coordinated employment of overwhelming forces, surprise and mobility, supported by sufficient reserves in materiel and man-power to insure a succession of effective impulses throughout the operations.

c. Latest information pertaining to the potential industrial capacities and military strengths of the opposing Powers, (excluding the U. S.) as of July 1, 1943, indicates that the Axis Powers will have about 400 divisions available in the European-Near East Theater and the Allied Powers approximately 100 divisions. To accomplish the numerical superiority, about 3 to 1, usually considered necessary before undertaking offensive operations, the Allies would have to raise about 700 divisions. A force of 700 divisions with appropriate supporting and service troops would approximate 22 million men. If Great Britain and the United States should induct so many men for military service, added to the tremendous numbers already under arms, the economic and industrial effort, necessary to conduct the

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war, would be definitely imperiled.

2. It is believed that the enemy can be defeated without meeting the numerical superiority indicated. Effective employment of modern air and ground fighting weapons and a tight economic blockade may create conditions that will make the realization of the Allied War Aims perfectly feasible with numerically less fighting men. Another million men in Flanders would not have turned the tide of battle for France. If the French army had had sufficient tanks and planes, and quantities of antitank and antiaircraft material, France might have remained a dominant power in Europe. In June, 1941, when the Germans launched their invasion of Russia, they knew that their adversary was numerically superior and could maintain that superiority in spite of tremendous losses. They probably also knew that Stalin was creating a military force of great power, consisting primarily of offensive modern fighting machines, and that if they delayed their "drive to the east" another year, Russia would possess armadas of air and ground machines which would not only render an offensive campaign impossible, but would make large demands upon the German military to secure her eastern frontier. The Crete campaign also presents illuminating evidence in favor of modern fighting means when opposed by superior numbers that are equipped with inappropriate means and are operating under World War I static tactical concepts. Approximately 17,000 Germans attacked and conquered the island which was defended by about 30,000 British.

3. Our broad concept, of encircling and advancing step-by-step, with a view to closing-in on Germany, will remain sound regardless of future developments in the European situation, for it envisages the only practical way in which military and economic pressure may be brought to bear effectively against Germany. The loss of potential bases of operation, presently available, would render the accomplish-

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ment of our strategic plans extremely difficult and costly. It is important, therefore, that the Allies take effective measures to hold the United Kingdom, the Middle East, and North African areas. Also the islands off the northwestern coast of Africa should be denied to the enemy. Before undertaking operations in connection with the establishment of additional military bases, for example, in the Scandinavian Peninsula, the Iberian Peninsula, Africa and the Low Countries, a careful survey of the areas of projected operations and a thorough examination of the enemy capabilities are mandatory. The unfortunate Norway campaign of 1940 is a glaring example of a total lack of appreciation of such realities on the part of those responsible for the British expedition. The Germans employed approximately 175,000 men, strongly supported by the Air Force, to conquer and secure their lodgement in Norway. Special Task Forces, including two mountain divisions and numerous parachute units made effective contributions to the success of the operation. Having gained a foothold, the Germans quickly established themselves in order to hold their bases and to facilitate exploitation. The British Forces despatched against Norway totalled about [illegible] men, with no mountain troops and with inadequate air supporting units. The failure of the British Expedition is directly attributable to insufficient and inappropriate means. If and when the situation indicates the feasibility of an Allied expedition, against Norway for example, powerful and appropriate means, especially trained and equipped for the task, must be provided. Large and effective reserves must be readily available to preclude dislodgement of the initial forces and to facilitate subsequent exploitation. A careful study of Norway, including the terrain and communications net, and a survey of possible enemy capabilities, indicate the necessity for mountain, infantry foot and motorized divisions, numerous

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parachute, tank, antitank, antiaircraft and air-borne units. The force required for the entire operation may total several hundred thousand men. The execution of the plan would be predicated on sea and local air superiority. The size of this force may appear large. However, even though our enemy may not be strong initially in the area of projected operations, the mobility of modern fighting means will enable him to concentrate destructive forces against us with unprecedented speed and surprise effect. The foregoing considerations apply with equal emphasis to proposed forces for other theaters of operations. Careful studies, concerning the Scandanavian Peninsula, the Iberian Peninsula, the Near East and Africa, have been made by the War Plans Division of the General Staff, and these studies made important contributions in the determination of the estimated Ground Forces (See Tab A). The enemy capabilities in those theaters in 1943 would obviously be conjecture. Task Forces consisting principally of armored and motorized divisions, must be created for possible operations in North Africa, the Middle East, France and the Low Countries. The exact strength and the composition of the Task Forces, necessary to seize and maintain military bases, will be determined immediately prior to the operation. We can avoid the unfortunate disasters experienced by our potential allies in Norway, France, the Balkans and in Crete by planning now and creating quickly the production capacity necessary to equip the ground forces recommended (Tab A). We must not suffer ignominious defeat and be expelled from the bases that we elect to establish. If the premises and assumptions made earlier in this study are appropriate and sound, additional strategically located bases are vital to the splendidly conceived plans of the Air Force and finally may serve as areas of departure for the combined operations of air and ground forces. The seizure, retention, and effective utilization of these bases is predicated on the successful operations of adequate sea, air and ground forces.

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5. Shipping was a bottleneck in the last war and again increased demands will be placed on all transportation facilities, particularly water, by constant troop movements and the expanded war industrial and economic effort. In order to transport and maintain effective forces in European areas, several million tons of shipping and adequate port facilities must be made available essentially for military service. To transport five million men with their modern air and mechanized equipment to European ports over a period of approximately one year would require about seven million tons of shipping or 1,000 ships. To maintain such a force in the theater of operations would require about ten million tons of shipping or 1,500 ships. But it is highly improbable that the situation in Europe will develop in such manner as to permit or to require operations involving the movement of so large a force across the Atlantic within the limited time of one year, even if the ship tonnage were available. The progressive building-up of large military forces in the theater will probably extend over a period of at least two years. This progressive movement would greatly reduce the demands upon maritime shipping for essentially military purposes and further would extend the period of time for the augmentation of maritime shipping now available. The realization of our present national policies may require operations in distant theaters by military forces of unprededented strength. It would be folly to create strong fighting forces without providing the transportation to move and maintain them in the contemplated theaters of operations. The maximum possible shipbuilding capacity of our country, coordinated of course with other essential demands upon industry and raw materials, must be exploited and continued in operation for the next several years.

6. The foregoing considerations clearly indicate the importance of creating a productive capacity in this country, that will provide

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the most modern equipment designed to give mobility and destructive power to our striking forces. The forces that we now estimate as necessary to realize our national objectives and for which production capacity must be provided, may not be adequate or appropriate. No one can predict the situation that will confront the United States in July, 1943. We may require much larger forces than those indicated below, and correspondingly greatly increased quantities of equipment. Emphasis has been placed on destructive power and mobility, with a view to offensive maneuvers in our principal theater of operations (Europe). The forces deemed necessary to accomplish the role of ground units in the supreme effort to defeat our potential enemies, total 5 Field Armies consisting of approximately 215 divisions (infantry, armored, motorized, air-borne, mountain and cavalry) with appropriate supporting and service elements. The strategic concept outlined in this paper contemplates distribution of U. S. ground forces approximately as follows: (More specific data will be found in Tab A).

Iceland	29,000
Scotland	11,000
England	41,000
Ireland	25,000
Hawaii	61,000
Puerto Rico	34,000
Panama	42,000
Alaska	29,000
Philippine Islands	25,000
Smaller Outlying Bases	32,000
Potential Task Forces	
First Army	775,500
Third Army	590,000
Fourth Army	710,000
Brazil	86,000
Colombia - Ecuador - Peru	37,000
Total	2,500,000
Strategic Reserves for which production capacity must be established but whose activation, location and training will be determined by developments in the international situation.	3,000,000
Troops in the Zone of the Interior and Fixed Defense Units (Ground)	1,200,000
TOTAL GROUND FORCES	6,700,000

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TAB A

The Ground Forces estimated as necessary to provide for the security of the U.S. outlying possessions, the Western Hemisphere and to make available appropriate forces for projected military operations follow:

1. Units organized, fully equipped and trained as soon as practicable:

a. Military Bases and Outlying Possessions.

Newfoundland	5,190
Greenland	2,931
Caribbean Bases	40,199
Puerto Rico	34,757
Panama	42,514
Hawaii	51,337
Philippines	25,397
Alaska	23,823
Iceland	23,709
Bases in British Isles	71,160
	340,217

b. Potential Task Forces

Brazil

1 Army Corps (1 Div. Inf, 1 Div. Air-Borne)	42,392
2 Artillery Battalions Each	1,804
1 Cavalry Regiment	1,591
5 Parachute Battalions	2,590
1 Antiaircraft Regiment and 2 Medium Battalions	3,619
2 Aircraft Warning Companies	2,800
2 Tank Battalions (Li Wt)	1,686
3 Anti-Tank Battalions	2,100
Services	23,254
Total	83,845

Colombia-Ecuador-Peru

1 Division	15,245
2 Artillery Battalions	1,400
3 Parachute Battalions	1,554
1 Antiaircraft Regiment and 2 Medium Battalions	3,619
2 Tank Battalions (Light)	1,086
1 Aircraft Warning Regiment	1,900
Services	13,035
Total	37,239

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First Army

1 Army consisting of 3 Corps of 3 Divisions ea.	242,216
2 Armored Corps consisting of 2 Armd Div. ea.	53,556
8 Divisions (4 Mtzd, 2 Mountain, 2 Air-borne)	108,516
5 Parachute Bns.	2,590
13 Artillery Bns. (4 heavy, 6 (105mm), 3 (75mm How Pk)	9,906
20 Antiaircraft Regts and 10 extra Bns. 37mm	44,970
11 Tank Battalions (3 Medium and 5 Light)	4,839
12 Aircraft Warning Regts	15,600
10 Tank Destroyer Bns; and 10 anti-tank Bn (Gun)	14,000
Services (Ord., Sig., Trag., Engr., Med.)	278,069
Total	779,262

Third Army

1 Army (3 Corps, 9 Divisions)	242,216
1 Armored Corps (2 Divisions)	25,778
2 Divisions Motorized	32,258
6 Artillery Battalions (Medium & Heavy)	4,300
1 Cavalry Corps and 2 M-Leez Regiments	26,867
2 Air-borne Division s	20,000
5 Parachute Battalions	2,590
5 Antiaircraft Regiments and three medium Bns.	12,166
3 Aircraft Warning Regiments	3,900
15 Tank Destroyers or Anti-Tank Battalions	10,500
Services	207,860
Total	589,435

Fourth Army

1 Army (3 Corps, 9 Divisions)	242,216
1 Armored Corps (2 Divisions)	25,394
4 Division s, Motorized	64,516
8 Artillery Battalions (Medium or Heavy)	8,200
4 Divisions (2 Mountain, 2 Air-borne)	44,000
2 Parachute Battalions	1,036
15 Antiaircraft Regiments and 10 Medium Bns.	37,345
8 Tank Battalions (Medium or Light)	4,839
6 Aircraft Warning Regiments	7,800
25 Tank Destroyers or Anti-Tank Battalions	17,500
Services	256,413
Total	709,859

Total Task Forces 2,199,441

c. The troops considered necessary in the ground forces, i.e. organized, fully equipped and trained, for current and future employment as security forces in military bases and outlying possessions, and as striking forces in any theater, follows:

Military Bases and Outlying Possessions	346,217
Potential Task Forces	2,199,441
Total	2,545,658

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2. Production capacity should be created to equip approximately 3 million for the reserve units indicated below. Activation, location and training of these units will depend upon the international situation.

2. Strategic Reserves.

2 Armies (10 Army Corps, 27 Divisions)
14 Armored Corps (53 Armored Divisions)
51 Divisions Motorized
115 Artillery Battalions, (Pack Medium or Heavy)
9 Divisions (2 Cavalry, 6 Mountain, 3 Air-Borne)
22 Parachute Battalions
129 Antiaircraft Regiments and 133 Medium Bns.
86 Tank Battalions (70 Medium, 6 Light, 10 Heavy)
29 Aircraft Warning Regiments
290 Tank Destroyer Battalions
262 Anti-Tank Battalions (Gun)

Total - Approximately	3,000,000

3. Ground troops required for the Zone of Interior and Fixed Defense Units 1,200,000

4. Recapitulation of Ground Forces

Military Bases and Outlying Possessions	346,217
Potential Task Forces	2,199,441
Zone of Interior - Fixed Defenses	1,200,000
Total	3,745,658
Units in reserve to be activated when situation requires	3,000,000
Total Army Ground Forces	6,745,658

5. Air Force requirements (details submitted in a separated study)

Air Force Combat	1,100,000
Zone of Interior Service Units	950,000
Total Air Force	2,050,000

6.

Army Ground Forces	6,745,658
Army Air Forces	2,050,000
TOTAL ARMY FORCES	8,795,658

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THE TASK (Condensed from ABC-1 & Rainbow 5)(Tab B)

1. To wage sustained air offensive against Germany in order to:
   - a. Reduce Axis surface and sub-surface operations.
   - b. Restrict Axis air operations.
   - c. Undermine German combat effectiveness by deprivation of essential supplies, production and communication facilities.
   - d. Permit and support a final invasion of Germany.
2. To conduct air operations in strategic defensive in the Orient.
3. To provide air action essential to the security of the continental United States, our possessions and the Western Hemisphere.

ACTION NECESSARY TO ACCOMPLISH THE TASK. (Air Estimate) (Tab 1)

1. Operations against Germany.
   - a. Disrupt major portion of electric power, destroy 50 selected targets
   - b. Disrupt German transportation 47 " "
   - c. Destroy 80% of synthetic petroleum establishments 27 " "
   - d. Destroy principal airplane assembly plants 18 " "
   - e. Destroy 90% of sources of aluminum 6 " "
   - f. Destroy major source of magnesium 6 " "

   (Total selected targets to destroy & keep destroyed) 154
   - g. Provide air support for Army-Navy and joint action incidental to invasion of Germany.
2. Strategic Defensive Operations Against Japan.(Tab 7)
   - a. Apply air action over northern approach to China seas.
   - b. Attack or threaten sources of military and civil strength in Japan.
3. Defense of cities' exposed factories, naval and air bases and other critical establishments in the continental United States, each possession and throughout Western Hemisphere against hit-and-run attacks by carriers or flying deckers, against internal disturbances within the Western Hemisphere and action against more remote possibility of the establishment of bases by small hostile forces.

FORCES REQUIRED TO ACCOMPLISH THE TASK IN OPERATIONS AGAINST GERMANY. (Tab 2)

(BASIS - Our ability to hit the selected targets will fall off in the same proportion when we move from our peacetime range to actual operations as the RAF Bomber Command experiences when moving from bomb range to actual objectives, day and night, good and bad weather, and opposed by anti-aircraft and pursuit.)

1. To destroy the 154 selected targets during a six month operating period (Tab 18) 6834 operating bombardment airplanes are required in accordance with current organization and operating rates. 6834 operating bombardment airplanes resolve themselves into 98 Groups, 392 Operating Squadrons, 98 Operational Training Squadrons and require 1708 additional airplanes for Depot Reserve and a monthly replacement of 1245 airplanes.
2. To protect the air bases occupied by our own striking force (maintaining the same ratio between bombardment and pursuit airplanes that the RAF includes in its ultimate force, 2 Bombers to 1 Pursuit),about 3400 Pursuit airplanes would be required.

INSUFFICIENCY OF AIR BASES FOR FORCE REQUIRED TO OPERATE AGAINST GERMANY. (Tab 4)

1. After the RAF has reached its ultimate strength, there will remain air bases available to units of the Army Air Forces as follows:

Bombardment			
In the U.K.	105 a/dms	42 Gps	(3026 Op. Aps)
In Near East	30 a/dms	12 Gps	(816 Op. Aps)
Total Bombardment	135 a/dms	54 Gps	(3842 Op. Aps)
Pursuit			
In the U.K.	25 a/dms	10 Gps	(1300 Op. Aps)
In Near East	9 a/dms	6 Gps	(780 Op. Aps)
Total Pursuit	34 a/dms	16 Gps	(2080 Op. Aps)
Bombardment			
Required	252 a/dms	98 Gps	(6834 Op. Aps)
Available	135 a/dms	54 Gps	(3842 Op. Aps)
Shortage	117 a/dms	44 Gps	(2992 Op. Aps)

2. Since we cannot base in the United Kingdom and the Near East 44 of the total required number of bombardment groups, these 2992 airplanes required for operations against Germany but for which bases are not available, should be airplanes with a 4000 tactical operating radius of action. Such airplanes are under development, could be employed against Germany from many British or United States controlled points on the Globe converging on Germany from all directions. This force in the field of air warfare would reverse the situation wherein Germany is a continent fighting an island and place Germany in the position of an island in air power under attack from all corners of the earth.
3. The 2992 required 4000 mile radius of action airplanes, although under development, cannot be available in necessary quantity earlier than 1945.

EXPEDIENT FORCED BY LACK OF AIR BASE FACILITIES. (Tab 4)

1. To initiate an air offensive in 1943 or 1944 (without waiting for the required 4000 mile radius of action airplanes) double combat crews must be employed. The disadvantages of the use of double combat crews are material but this expediency is unavoidable. As a result, for initial offensive air operations against Germany the following force is required:

Aircraft Type	Total Gps	Operating Airplanes	Monthly Rep. in Airplanes
M/B B-25, 26 types *	10	850	286
H/B B-17, 24 types	20	1360	456
H/B B-29, 32 types *	24	1632	546
	54	3842	1288

* These airplanes included because of availability only. Longer range, greater load carrying airplanes would be far more economical. These airplanes to be replaced by longer range airplanes at the earliest possible date.

2. The "Interim Expedient" Air Force tabulated above would be more than twice as powerful if all bombardment airplanes were B-29 type rather than the type indicated. Again, time requires the use of shorter range, less efficient and much less economical airplanes (per ton of bombs delivered on the objective).

FORCE REQUIRED TO ACCOMPLISH THE TASK OF DEFENDING THE CONTINENTAL UNITED STATES, OUR POSSESSIONS AND THE HEMISPHERE. (Tabs 6 & 9)

1. Eventual. After the American aviation industry is turning out thousands of bombers monthly, after the Army Air Forces are graduating about 9,000 pilots monthly, and while an offensive is being waged against Germany and Europe, security in the continental United States, each possession and the Western Hemisphere can be assured against any eventuality if the Army Air Forces have available a minimum force consisting of:

Location	Bomb. Gps	(Total Aps. less O.R.)	Pur.* Gps	(Total Aps. less O.R.)
Cont. U. S.	5	(340)	12	(1960)
(New Eng. Area)	(1)	68		
(Norfolk Area)	(1)	68		
(So. Calif.)	(1)	68		
(San Fran. Bay)	(1)	68		
(Seattle,Wash.)	(1)	68		
Greenland	1	(68)		
Newfoundland	1	(68)	2	(260)
Labrador	-	-		
Puerto Rico	1	(68)	1	(130)
British Guiana	1	(68)		
Trinidad	-	-	1½	(195)
Saint Lucia	-	-		
Antigua	-	-		
Brazil	3	(204)		
(Belem)	(1)	68		
(Natal)	(1)	68		
(Rio de Janeiro)	(1)	68		
Other Latin-American & U.S. needs	—	6		(780)
Chile,Antofagasta	1	(68)		
Peru, Lima	1	(68)		
Mexico,Acapulco	1	(68)		
Panama	2	(136)	2	(260)
Hawaii	3	(204)	3	(390)
Alaska	2	(136)	1½	(195)
Iceland	1	(68)	1	(130)
Bermuda	-	-	½	(65)
Bahamas & Jamaica	-	-	½	(65)
Philippines	2	(136)	1	(130)
TOTAL	29	1700	32	4160

* Additional Pursuit units set up (in Summary TAB 1) among 21 for offensive against Germany to be initially employed in Hemisphere defense as follows:

Air Base Defense, Brazil	3 Groups	390 Aps.
Metropolitan Defense,Rio de Janeiro	1 Group	130 Aps.
Air Base Defense, Chile & Peru	1 Group	130 Aps.
	5 Groups	650 Aps.

BRIEF

MUNITIONS REQUIREMENTS

OF THE

ARMY AIR FORCES

All Tab references pertain to supporting study on same subject approved by the Chief of Staff September 1, 1941.

SUMMARY

REQUIREMENT OF ARMY AIR FORCES TO DEFEAT OUR POTENTIAL ENEMIES

AIR FORCE MISSIONS	FORCES REQUIRED						
		INTERIM EXPEDIENT FORCE			ULTIMATE FORCE		
	Type Aps.	Groups	Airplanes (Including Depot Res)	Monthly Replacement In Aps.	Groups	Airplanes (Including Depot Res)	Monthly Replacement in Aps.
AIR OFFENSIVE AGAINST GERMANY (1)Destroy industrial war-making capacity of Reich. (2)Neutralize Luftwaffe (3)Thus permitting invasion.	B-25&26	10	1042	286	10	1062	143
	B-17&24	20	1700	456	20	1700	228
	B-29	24	2040	546	24	2040	273
			4802		44	3742	501
	Day Pur.	21	2756	334	21	2756	334
	Night *		456	80		656	90
			3212				
DEFEND U.S., POSSESSIONS & HEMISPHERE	B-17&24	33*	2805	70	25	2125	81
	Day Pur.	32	4200	114	32	4200	90
	Night *		1000	27		1000	27
STRATEGIC DEFENSIVE IN ASIA	B-17&24	2	170	21	2	170	34
	Day Pur.	1	132	17	1	132	17
	Night *		31	4		31	4
AIR SUPPORT FOR GROUND FORCES (APPROPRIATE TO SIZE GROUND FORCES SET UP IN TAB D)	A-20	13	946	42	13	946	42
	B/Bombers	13	1255	56	13	1255	56
	Chan.	10⅔ G	1901	93	10⅔ G	1901	93
	Photo	2	142	23	2	142	23
	Transport	19	1520	77	19	1520	77
	Gliders	**	(3000)	(153)		(3000)	(153)
AAF MAINTENANCE	Transport	13	1040	25	13	1040	25
TRAINING	All Types	--	37061	--	--	37061	--
GRAND TOTAL		203 + 10⅔ G	59229	2274	139 + 13⅓ G	63447	2133

* (Including 8 Gps. (640 airplanes) not included in total)
** (Not included in totals)

PERSONNEL	INTERIM EXPEDIENT FORCE		ULTIMATE FORCE	
Officers	90,391 Pilots AC		103,482 Pilots AC	
	31,186 Combat Crew AC		32,042 Combat Crew AC	
	39,214 Non-Flying AC		47,798 Non-Flying AC	
	18,607 Other Branch	179,398	12,496 Other Branch	195,779
Enlisted Men	813,951 AC-Technicians		942,439 AC Technicians	
	688,247 AC Non-Technical		124,213 AC Non-Technical	
	470,523 Other Branch	1,972,721	422,396 Other Branch	1,969,237
GRAND TOTAL	.....	2,041,721	.....	2,164,016

2. Immediate. A large measure of security assured under the conditions stated above is due to the output rate of airplanes and trained personnel stated plus the fact that a period of about six months would be required by the Germans after winning the war in Europe and before changing to an offensive against the Western Hemisphere. Until those output rates are established, even though an offensive is being waged against Germany, security against any eventuality cannot be guaranteed without an additional force of at least 8 Heavy Bombardment Groups (544 total airplanes less reserve) in the Western Hemisphere. These 8 Groups would constitute a reserve to meet a threat greater than that conveyed by 1 or 2 ships or to "bomb them out" in the event that a small force established a base in the Western Hemisphere. This 8 group general reserve would probably be located in the United States the greater portion of the time.
3. General. If no offensive is being waged against Germany in Europe, a much larger force than that set up in the foregoing will be essential if the security of the continental United States, each of our possessions and the Western Hemisphere is to be assured against any eventuality.

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BRIEF

MUNITIONS REQUIREMENTS

OF THE

ARMY AIR FORCES

...nces pertain to supporting study on same subject ...e Chief of Staff September 1, 1941.

SUMMARY

...MY AIR FORCES TO DEFEAT OUR POTENTIAL ENEMIES

FORCES REQUIRED

	INTERIM EXPEDIENT FORCE			ULTIMATE FORCE		
...roups	Airplanes (Including Depot Res)	Monthly Replacement In Ars.		Groups	Airplanes (Including Depot Res)	Monthly Replacement in Ars.
...10	1062	286		10	1062	143
...20	1700	456		20	1700	228
...24	2040	546		24	2040	273
				44	3740	501
...21	2756	334		21	2756	334
	656	80			656	80
...33*	2805	70		25	2125	81
...32	4200	114		32	4200	90
	1000	27			1000	27
...2	170	21		2	170	34
...1	132	17		1	132	17
	31	4			31	4
...13	926	42		13	926	42
...13	1255	66		13	1255	66
...00 Sq	1901	98		100 Sq	1901	98
...2	142	23		2	142	23
...19	1520	77		19	1520	77
...**	(3000)	(153)			(3000)	(153)
...13	1040	25		13	1040	25
...	37061	--		--	37061	--
...03 + ...00 Sq	59027	2274		230 + 198 Sq	63447	2133

...ing 8 Gps. (680 airplanes) not included in total)
...cluded in totals)

...EDIENT FORCE		ULTIMATE FORCE	
...s AC		103,482 Pilots AC	
...& Crew AC		32,044 Combat Crew AC	
...lying AC		40,798 Non-Flying AC	
... Branch	179,338	18,355 Other Branch	195,479
...chnicians		842,439 AC Technicians	
...o-Technical		(14,213 AC Non-Technical	
... Branch	1,281,721	490,395 Other Branch	1,672,237
.....	2,061,721	.....	2,164,016

...e. A large measure of security assured ...e conditions stated above is due to the ...te of airplanes and trained personnel ...us the fact that a period of about six ...uld be required by the Germans after ...he war in Europe and before changing to ...ive against the Western Hemisphere. ...ge output rates are established, even ... offensive is being waged against ...security against any eventuality cannot ...ded without an additional force of at ...eavy Bombardment Groups (544 total air...s reserve) in the Western Hemisphere. ...roups would constitute a reserve to meet ...greater than that conveyed by 1 or 2 ...to "bomb them out" in the event that a ...ce established a base in the Western ...e. This 8 group general reserve would ...e located in the United States the ...ortion of the time.

...If no offensive is being waged against ...n Europe, a much larger force than that ...the foregoing will be essential if the ...of the continental United States, each ...ssessions and the Western Hemisphere is ...ured against any eventuality.

FORCE REQUIRED TO ACCOMPLISH THE TASK OF STRATEGIC DEFENSIVE AIR OPERATIONS IN ASIA. (Tab 7)

1. Conception. If a shortage of airplanes were not the controlling factor, a satisfactory strategic defensive against Japan could be most effectively accomplished by a vigorous air offensive against the sources of Japan's military and civil strength. Actualities force the modification of that conception to the creation of a striking force designed to deter Japanese expansion and aggression in Asia.

2. Minimum immediate requirements. In addition to the forces set up for the defense of the Philippines and Alaska, it will be necessary to add 2 Heavy Bombardment Groups (136 total airplanes less reserve) and 1 Pursuit Group (130 airplanes less reserve) to the air garrison of the Philippine Department to attack or to threaten Japanese sea communications in the China Seas and Japanese source of military and civil strength.

FORCES REQUIRED TO ACCOMPLISH THE TASK OF AIR SUPPORT TO THE ARMY. (Tab 12)

1. Basis: An invasion by the United States Army of Germany or German controlled areas will not be attempted until the air offensive against Germany has been successful and we can control the air over the area of the invasion to a very large measure. By that time, a large proportion of the force set up for the air offensive against Germany will be available to support invading surface forces. Hence, the force set up below is the bare minimum to permit the training of the invading forces and to provide limited support in violent ground actions such as the suppression of disturbances in the Hemisphere or the ejecting of small hostile forces from the Hemisphere or our possessions.

2. The Air Support Force appropriate to a ground Army of the size set up in this paper is as follows:

Location	L/E	D/B	Trans.	Obsn.
	(Ea GP)	(Ea. Gp)		
	(47 Acft)	(77 Acft)		
First Air Support Command (First Army)	2 Gps	2 Gps		
Second Air Support Command (Second Army)	*	*	13 Grs (832 airplanes) for continental U.S. and strategic reserve	1 Gp for Armies, 1 Gp for Corps, 1 Gp for Armored Div.
Third Air Support Command (Third Army)	*	*		
Fourth Air Support Command (Fourth Army)	*	*		
Fifth Air Support Command (Armored Force)	*	*		
Iceland	1 Sq	1 Sq		1 Sq
Brazil	1 Gp	1 Gp	4 Gps	3 Sqs
Puerto Rico	1 Sq	1 Sq		1 Sq
Trinidad	1 Sq	1 Sq		
Panama	1 Sq	1 Sq		1 Sq
Columbia-Ecuador-Peru	1 Sq	1 Sq		1 Sq
Alaska	2 Sq	2 Sq	1 Gp	1 Sq
Hawaii	1 Sq	1 Sq		1 Sq
Philippines	2 Sq	2 Sq		1 Sq
Caribbean Defense Command			1 Gp	
Continental United States & Strategic Reserves			13 Gps	
QMC			4 Gps Photomap (mapping)	

3000 (600 of which are Depot Reserve) 15 Man Gliders, distribution undetermined.

1 Pursuit Group per each Support Command is included among the 6 Pursuit Groups set up for other Latin American and U.S. defense needs.

PLANS FOR THE AIR TO PROVIDE AIR SUPPORT FOR THE AIR FORCES. (Tab 13)

In order to maintain the services required by the air forces set up in the foregoing using the minimum amount of air transports estimated as essential, there are required 13 Transport Groups (1040 transports, including Depot Reserve to consist of 140 4-engine long range and 680 2-engine medium range transports, all with approximately 30-man capacity).

TRAINING REQUIREMENTS TO BUILD AND TO MAINTAIN THE ARMY AIR FORCES. (Tab 15)

1. The critical element insofar as training of personnel is concerned, consists of the training of pilots requiring to form and to maintain the Air Forces set up above. While the Interim Expedient Air Force is operating, it is estimated that attrition will require the graduation of 85,236 pilots per year. In order to expand our pilot training establishment from the present objective (30,000 graduates per year) to a 85,236 rate, 47 new flying schools will be required.

2. When the ultimate Air Force is organized and the necessity for operations by double combat crews no longer exists, the annual replacement requirement is estimated as 108,528. This rate will require 72 additional flying schools beyond those set up to graduate 30,000 per year.

3. Flying schools to graduate 85,236 per year would be set up immediately upon the approval of this program. These schools would be expanded to the 108,528 rate approximately one year before the ultimate Air Force could be established. It will be noted that this date is indefinite but considerably earlier than the ultimate Air Force would set up under that heading in war as far as the procurement of airplanes is concerned.

REQUIREMENTS IN TRAINING AIRPLANES (Tab 15)

Training airplanes by number and type will be required to produce the numbers of graduated pilots annually, in accordance with the table below:

Operating Training Type Airplanes.

Type	85,236 Graduated Pilots per year for Interim Expedient Air Force	108,528 Graduated Pilots per year for Ultimate Air Force
Primary Trainer	8520	11115
Basic Trainer	8804	11486
Adv. Trainer - 1-Engine	2954	3853
Adv. Trainer - 2-Engine	5736	7484
Bombardment	1988	2592
Observation	341	445
Transport	57	74
TOTAL TRAINING	28400	37051

TIME TO MEET TRAINING REQUIREMENTS.

As a general statement, pilots can be trained prior to the dates that the combat airplanes which the pilots are to operate can be manufactured.

For example, if the necessary numbers of additional Primary Training type airplanes (4195) can be added to those expected to be on hand (2325 plus 4195 equals 8520) on February 15, 1942, it would be possible to start the expanded pilot training schools in operation on May 15, 1942. It would then be possible to man and to meet war time attrition on the Interim Expedient Air Force by November 1, 1943, without in erfering with the 54 Group Program. Tab 20 indicates that the date November 1, 1943, is far ahead of the date on which it is possible to manufacture all of the combat airplanes included in the Interim Expedient Air Force.

PERSONNEL REQUIREMENTS. (Tab 16)

To man and to operate Army Air Forces of the size and composition set forth in the foregoing, to operate all training, maintenance and overhead installations necessary therewith, there will be required personnel approximately as follows:

Officers	Interim Expedient	Eventual
Pilots	103,482	90,392
Navigators	21,462	19,866
Bombardiers	7,392	6,126
Observers	3,196	3,196
Total Flying	135,526	121,577
Non-Flying AC	40,798	39,214
Total AC	176,324	160,791
Other Branches	18,355	18,407
TOTAL	195,679	179,198
Enlisted Men		
Technicians AC*	842,439	813,951
Non-Technical AC	614,203	588,267
Total AC	1,456,642	1,302,218
Other Branches	490,395	479,503
TOTAL	1,947,237	1,881,721
GRAND TOTAL	2,164,916	2,061,119

* Approximately one year required for training to degree necessary for operations. Twenty-two new technical schools will be required therefor. These numbers include approximately 50,000 enlisted members of combat crews.

MANUFACTURE OF AIRPLANES. (Tab

The numbers of additional facto... airplane factories is determin... placement rates required to su... forth in the foregoing in war ... number of airplanes of each ty... (in addition to current orders) ...tain the Army Air Forces in one ... included in Tab D to the compil... Board.

Aircraft Types	INTERIM EXPEDI... Monthly Replace... ments Required
M/Bomb B-26	286
H/Bomb B-17	547
H/Bomb B-29	546
H/Bomb 4000 mile	
Dive & Light	98
Total Bombardment	1477
Pursuit	576
Observation & Photo	121
Transport	102
GRAND TOTAL	2276

POSSIBILITY TO MANUFACTURE ... (Tab 20)

It is within the capacity of the... the Army Air Forces indicated in...

An air offensive against Germany ... token force of 3 Heavy Bombardm... 1942.

If an all out effort is initiate... air offensive against Germany ca... in April 1944.

The air offensive against Germany ... full power.

COMPARISON OF OPPOSING AIR FORCES

In operations against Germany, th... relationship between the Germany ... bined strength of the Army Air Fo... Force will be as follows:

	GAF
July 1, 1943	
Bombers	62%
Pursuit	22%
Fighter	90%
Total Combat	83%
Mid 1944	
Bombers	
Pursuit	22%
Fighter	90%
Total Combat	14%
Ultimate	
Bombers	
Pursuit	22%
Fighter	90%
Total Combat	

The numerical comparison is no tr... relative strength of the opposing ... have a superiority in performance ... it is proposed to maintain that s... the war by exploiting the superio... Bombers to the utmost.

The grand total Army Air Forces s... going is a large force. It is de... war.

CONCLUSION.

The forces required to accomplish ... Army Air Forces have been compute... represent the minimum force neces... each task. Any reduction in forc... clude a reduction in task.

For example, if the 25 groups req... of the United States, our possess... Hemisphere cannot be made availab... reduced to the defense of a speci... Hemisphere or of specified posses...

If the required combat airplanes ... the Army Air Forces, personnel ca... and to operate those air forces s... airplanes can be manufactured.

The Army Air Forces are prepared ... mission in the defense of our pote... soon as American aviation industry ... the required airplanes.

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...LISH THE TASK OF STRATEGIC ... IN ASIA. (Tab 7)

...portage of airplanes were not ...or, a satisfactory strategic ...gen could be most effectively ...gorous air offensive against ...'s military and civil strength. ...e modification of that concep- ... of a striking force designed ...pansion and aggression in Asia.

...quirements. In addition to the ... defense of the Philippines ...be necessary to add 2 Heavy ...136 total airplanes less ...it Group (139 airplanes less ...garrison of the Philippine ... or to threaten Japanese sea ... China Seas and Japanese ...d civil strength.

...LISH THE TASK OF AIR SUPPORT

...y the United States Army of ...trolled areas will not be ...ir offensive against Germany ...nd we can control the air ... invasion to a very large ...e, a large proportion of the ...air offensive against Germany ...support invading surface ...orce set up below is the bare ... training of the invading ... limited support in violent ...s the suppression of dis- ...sphere or the ejection of ...from the Hemisphere or our

...appropriate to a ground Army ... this paper is as follows:

...(Ea GP)	(Ea. Gp) (57 Acs)	(77 Acs)			
	L/P	D/B	Trans.	Chan.	
...2 Gps	2 Gps				
...	...	...			13 Gps (892 airplanes) for continental U.S. and strategic reserve
...	...	...			2 Gps for Iceland, 1 Gp for Caribbean, 1 Gp for Alaska, 2 Gps for Armored Div.
...	...	...			
...	...	...			
...	...	...		

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THE TASK (Condensed from ABC-1 & Rainbow 5)(Tab B)

1. To wage sustained air offensive against Germany in order to:

   a. Reduce Axis surface and sub-surface operations.

   b. Restrict Axis air operations.

   c. Undermine German combat effectiveness by deprivation of essential supplies, production and communication facilities.

   d. Permit and support a final invasion of Germany.

2. To conduct air operations in strategic defensive in the Orient.

3. To provide air action essential to the security of the continental United States, our possessions and the Western Hemisphere.

ACTION NECESSARY TO ACCOMPLISH THE TASK. (Air Estimate) (Tab 1)

1. Operations against Germany.

   a. Disrupt major portion of electric power, destroy 50 selected targets

   b. Disrupt German transportation 47 " "

   c. Destroy 80% of synthetic petroleum establishments 27 " "

   d. Destroy principal airplane assembly plants 18 " "

   e. Destroy 90% of sources of aluminum 6 " "

   f. Destroy major source of magnesium 6 " "

   (Total selected targets to destroy & keep destroyed) 154

   g. Provide air support for Army-Navy and joint action incidental to invasion of Germany.

2. Strategic Defensive Operations Against Japan.(Tab 7)

   a. Apply air action over northern approach to China seas.

   b. Attack or threaten sources of military and civil strength in Japan.

3. Defense of cities' exposed factories, naval and air bases and other critical establishments in the continental United States, each possession and throughout Western Hemisphere against hit-and-run attacks by carriers or flying deckers, against internal disturbances within the Western Hemisphere and action against more remote possibility of the establishment of bases by small hostile forces.

FORCES REQUIRED TO ACCOMPLISH THE TASK IN OPERATIONS AGAINST GERMANY. (Tab 2)

(BASIS - Our ability to hit the selected targets will fall off in the same proportion when we move from our peacetime range to actual operations as the RAF Bomber Command experiences when moving from bomb range to actual objectives, day and night, good and bad weather, and opposed by anti-aircraft and pursuit.)

1. To destroy the 154 selected targets during a six month operating period (Tab 18) 6834 operating bombardment airplanes are required in accordance with current organization and operating rates. 6834 operating bombardment airplanes resolve themselves into 98 Groups, 392 Operating Squadrons, 98 Operational Training Squadrons and require 1708 additional airplanes for Depot Reserve and a monthly replacement of 1245 airplanes.

2. To protect the air bases occupied by our own striking force (maintaining the same ratio between bombardment and pursuit airplanes that the RAF includes in its ultimate force, 2 Bombers to 1 Pursuit),about 3400 Pursuit airplanes would be required.

INSUFFICIENCY OF AIR BASES FOR FORCE REQUIRED TO OPERATE AGAINST GERMANY. (Tab 4)

1. After the RAF has reached its ultimate strength, there will remain air bases available to units of the Army Air Forces as follows:

Bombardment		
In the U.K.	105 srdns	42 Gps (3026 Op. Acs)
In Near East	30 srdns	12 Gps (816 Op. Acs)
Total Bombardment	135 srdns	54 Gps (3842 Op. Acs)
Pursuit		
In the U.K.	25 srdns	10 Gps (1300 Op. Acs)
In Near East	9 srdns	6 Gps (780 Op. Acs)
Total Pursuit	34 srdns	16 Gps (2080 Op. Acs)
Bombardment		
Required	252 srdns	98 Gps (6834 Op. Acs)
Available	135 srdns	54 Gps (3842 Op. Acs)
Shortage	117 srdns	44 Gps (2992 Op. Acs)

2. Since we cannot base in the United Kingdom and the Near East 44 of the total required number of bombardment groups, these 2992 airplanes required for operations against Germany but for which bases are not available, should be airplanes with a 4000 tactical operating radius of action. Such airplanes are under development, could be employed against Germany from many British or United States controlled points on the Globe converging on Germany from all directions. This force in the field of air warfare would reverse the situation wherein Germany is a continent fighting an island and place Germany in the position of an island in air power under attack from all corners of the earth.

3. The 2992 required 4000 mile radius of action airplanes, although under development, cannot be available in necessary quantity earlier than 1945.

EXPEDIENT FORCED BY LACK OF AIR BASE FACILITIES. (Tab 4)

1. To initiate an air offensive in 1943 or 1944 (without waiting for the required 4000 mile radius of action airplanes) double combat crews must be employed. The disadvantages of the use of double combat crews are material but this expediency is unavoidable. As a result, for initial offensive air operations against Germany the following force is required:

Aircraft Type	Total Gps	Operating Airplanes	Monthly Rep. in Airplanes
M/B B-25, 26 types *	10	850	286
H/B B-17, 34 types	20	1360	456
H/B B-29, * 32 types	24	1612	546
	54	3822	1288

* These airplanes included because of availability only. Longer range, greater load carrying airplanes would be far more economical. These airplanes to be replaced by longer range airplanes at the earliest possible date.

2. The "Interim Expedient" Air Force tabulated above would be more than twice as powerful if all bombardment airplanes were B-29 type rather than the type indicated. Again, time requires the use of shorter range, less efficient and much less economical airplanes (per ton of bombs delivered on the objective).

FORCE REQUIRED TO ACCOMPLISH THE TASK OF DEFENDING THE CONTINENTAL UNITED STATES, OUR POSSESSIONS AND THIS HEMISPHERE. (Tabs 6 & 9)

1. Eventual. After the American aviation industry is turning out thousands of bombers monthly, after the Army Air Forces are graduating about 9,000 pilots monthly, and while an offensive is being waged against Germany and Europe, security in the continental United States, each possession and the Western Hemisphere can be assured against any eventuality if the Army Air Forces have available a minimum force consisting of:

Location	Bomb. Gps	(Total Acs. less R.R.)	Pur.* Gps	(Total Acs. less R.R.)
Cont. U. S.	5	(340)	12	(1560)
(New Eng. Area)	(1)	68		
(Norfolk Area)	(1)	68		
(So. Calif.)	(1)	68		
(San Fran. Bay)	(1)	68		
(Seattle,Wash.)	(1)	68		
Greenland	1	(68)	2	(260)
Newfoundland	1	(68)		
Labrador	-	-		
Puerto Rico	1	(68)	1	(130)
British Guiana	1	(68)	1½	(195)
Trinidad	-	-		
Saint Lucia	-	-		
Antigua	-	-		
Brazil	3	(204)		
(Belen)	(1)	68		
(Natal)	(1)	68		
(Rio de Janeiro)	(1)	68		
Other Latin-American & U.S. needs		—	6	(780)
Chile,Antofagasta	1	(68)		
Peru, Lima	1	(68)		
Mexico,Acapulco	1	(68)		
Panama	2	(136)	2	(260)
Hawaii	3	(204)	3	(390)
Alaska	2	(136)	1½	(195)
Iceland	1	(68)	1	(130)
Bermuda	-	-	½	(65)
Bahamas & Jamaica	-	-	½	(65)
Philippines	2	(136)	1	(130)
TOTAL	25	1700	32	4160

* Additional Pursuit units set up (in Summary TAB 1) among 21 for offensive against Germany to be initially employed in Hemisphere defense as follows:

Air Base Defense, Brazil	3 Groups	390 Acs.
Metropolitan Defense,Rio de Janeiro	1 Group	130 Acs.
Air Base Defense, Chile & Peru	1 Group	130 Acs.
	5 Groups	650 Acs.

BRIEF

MUNITIONS REQUIREMENTS

OF THE

ARMY AIR FORCES

All Tab references pertain to supporting study on same subject approved by the Chief of Staff September 1, 1941.

SUMMARY

REQUIREMENT OF ARMY AIR FORCES TO DEFEAT OUR POTENTIAL ENEMIES

AIR FORCE MISSIONS	FORCES REQUIRED						
		INTERIM EXPEDIENT FORCE			ULTIMATE FORCE		
	Type Acs.	Groups	Airplanes (Including Depot Res)	Monthly Replacement In Acs.	Groups	Airplanes (Including Depot Res)	Monthly Replacement in Acs.
AIR OFFENSIVE AGAINST GERMANY (1)Destroy industrial war-making capacity of Reich. (2)Neutralize Luftwaffe (3)Thus permitting invasion.	B-25&26	10	1062	286	10	1062	143
	B-17&24	20	1700	456	20	1700	228
	B-29	24	2040	546	24	2040	273
	4000 mi. Day Pur.	21	2756	334	44	3740	501
	Night *		456	80	21	2756	334
						656	80
DEFEND U.S., POSSESSIONS & HEMISPHERE	B-17&24	33*	2806	70	25	2125	81
	Day Pur.	32	4200	114	32	4200	90
	Night *		1000	27		1000	27
STRATEGIC DEFENSIVE IN ASIA	B-17&24	2	170	21	2	170	34
	Day Pur.	1	132	17	1	132	17
	Night *		31	4		31	4
AIR SUPPORT FOR GROUND FORCES (APPROPRIATE TO [illegible] SIZE GROUND FORCES SET UP IN TAB D)	A-20	13	946	42	13	946	42
	B/Bombers	13	1265	66	13	1265	66
	[illegible]an.	10* 51	1901	98	10* 51	1901	98
	Photo	2	142	23	2	142	23
	Transport	19	1520	77	19	1520	77
	Gliders	**	(3000)	(153)		(3000)	(153)
AAF MAINTENANCE	Transport	13	1040	25	13	1040	25
TRAINING	All Types	--	37061	--	--	37061	--
GRAND TOTAL		203 * 10* 51	59727	2274	239 * 10* 51	63467	2133

* (Including 8 Gps. (680 airplanes) not included in total)

** (Not included in totals)

PERSONNEL	INTERIM EXPEDIENT FORCE		ULTIMATE FORCE	
Officers	90,391 Pilots AC		103,492 Pilots AC	
	31,186 Combat Crew AC		32,044 Combat Crew AC	
	39,214 Non-Flying AC		43,798 Non-Flying AC	
	18,607 Other Branch	179,398	19,355 Other Branch	196,479
Enlisted Men	813,951 AC-Technicians		902,439 AC Technicians	
	588,267 AC Non-Technical		614,413 AC Non-Technical	
	479,503 Other Branch	1,881,721	402,395 Other Branch	1,919,237
GRAND TOTAL	.....	2,041,721	.....	2,144,016

2. Immediate. A large measure of security assured under the conditions stated above is due to the output rate of airplanes and trained personnel stated plus the fact that a period of about six months would be required by the Germans after winning the war in Europe and before changing to an offensive against the Western Hemisphere. Until those output rates are established, even though an offensive is being waged against Germany, security against any eventuality cannot be guaranteed without an additional force of at least 8 Heavy Bombardment Groups (544 total airplanes less reserve) in the Western Hemisphere. These 8 Groups would constitute a reserve to meet a threat greater than that conveyed by 1 or 2 ships or to "bomb them out" in the event that a small force established a base in the Western Hemisphere. This 8 group general reserve would probably be located in the United States the greater portion of the time.

3. General. If no offensive is being waged against Germany in Europe, a much larger force than that set up in the foregoing will be essential if the security of the continental United States, each of our possessions and the Western Hemisphere is to be assured against any eventuality.

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BRIEF

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SUMMARY

...F ARMY AIR FORCES TO DEFEAT OUR POTENTIAL ENEMIES

FORCES REQUIRED

	INTERIM EXPEDIENT FORCE			ULTIMATE FORCE		
	Groups	Airplanes (Including Depot Res)	Monthly Replacement In Acs.	Groups	Airplanes (Including Depot Res)	Monthly Replacement In Acs.
	10	1062	266	10	1062	143
	20	1700	454	20	1700	228
	24	2040	544	24	2040	273
				44	3740	501
	21	2756	334	21	2756	334
		656	80		656	80
	33*	2805	70	25	2125	81
	32	4200	114	32	4200	90
		1000	27		1000	27
	2	170	21	2	170	34
	1	132	17	1	132	17
		31	4		31	4
	13	926	42	13	926	42
	13	1248	56	13	1248	56
	20* S.	1901	98	20* S.	1901	98
	2	142	23	2	142	23
	19	1520	77	19	1520	77
	**	(3000)	(153)		(3000)	(153)
	13	1040	26	13	1040	26
	--	37061	--	--	37061	--
	203 + 20* S.	59727	2276	230 + 20* S.	63467	2133

...uding 8 Gps. (680 airplanes) not included in total)
...included in totals)

EXPEDIENT FORCE		ULTIMATE FORCE	
...ots AC		103,482 Pilots AC	
...ent Crew AC		32,022 Combat Crew AC	
...Flying AC		40,798 Non-Flying AC	
...r Branch	179,398	19,255 Other Branch	196,479
...Technicians		842,439 AC Technicians	
...Non-Technical		614,413 AC Non-Technical	
...r Branch	1,881,721	492,395 Other Branch	1,949,237
.....	2,061,721	.....	2,144,916

...e. A large measure of security assured ...e conditions stated above is due to the ...ate of airplanes and trained personnel ...lus the fact that a period of about six ...ould be required by the Germans after ...the war in Europe and before changing to ...sive against the Western Hemisphere. ...hose output rates are established, even ...n offensive is being waged against ... security against any eventuality cannot ...ained without an additional force of at ...Heavy Bombardment Groups (544 total air...ess reserve) in the Western Hemisphere. ...Groups would constitute a reserve to meet ... greater than that conveyed by 1 or 2 ... to "bomb then out" in the event that a ...rce established a base in the Western ...re. This 8 group general reserve would ...be located in the United States the ...portion of the time.

... If no offensive is being waged against ...in Europe, a much larger force than that ... the foregoing will be essential if the ... of the continental United States, each ...ssessions and the Western Hemisphere is ...ured against any eventuality.

FORCE REQUIRED TO ACCOMPLISH THE TASK OF STRATEGIC OFFENSIVE AIR OPERATIONS IN ASIA. (Tab 7)

1. Conception. If a shortage of airplanes were not the controlling factor, a satisfactory strategic defensive against Japan could be most effectively accomplished by a vigorous air offensive against the sources of Japan's military and civil strength. Actualities force the modification of that conception to the creation of a striking force designed to deter Japanese expansion and aggression in Asia.

2. Minimum immediate requirements. In addition to the forces set up for the defense of the Philippines and Alaska, it will be necessary to add 2 Heavy Bombardment Groups (136 total airplanes less reserve) and 1 Pursuit Group (130 airplanes less reserve) to the air garrison of the Philippine Department to attack or to threaten Japanese sea communications in the Orient Seas and Japanese source of military and civil strength.

FORCES REQUIRED TO ACCOMPLISH THE TASK OF AIR SUPPORT TO THE ARMY. (Tab 10)

1. Basis: An invasion by the United States Army of Germany or German controlled areas will not be attempted until the air offensive against Germany has been successful and we can control the air over the area of the invasion to a very large measure. By that time, a large proportion of the force set up for the air offensive against Germany will be available to support invading surface forces. Hence, the force set up below is the bare minimum to permit the training of the invading forces and to provide limited support in violent ground actions such as the suppression of disturbances in the Hemisphere or the ejection of small hostile forces from the Hemisphere or our possessions.

2. The Air Support Force appropriate to a Ground Army of the size set up in this paper is as follows:

Location	(To GHQ Res.) (40 Acs)	(To GHQ Res.) (77 Acs)	Trans.	Chem.
First Air Support Command (First Army)	2 Gps	2 Gps		
Second Air Support Command (Second Army)	*	*		
Third Air Support Command (Third Army)	*	*		
Fourth Air Support Command (Fourth Army)	*	*		
Fifth Air Support Command (Armored Force)	*	*		
Iceland	1 Sq	1 Sq		1 Sq
Brazil	1 Gp	1 Gp	4 Gps	3 Sqs
Puerto Rico	1 Sq	1 Sq		1 Sq
Trinidad	1 Sq	1 Sq		
Panama	1 Sq	1 Sq		1 Sq
Columbia-Ecuador-Peru	1 Sq	1 Sq		1 Sq
Alaska	1 Sq	2 Sq	1 Gp	1 Sq
Hawaii	1 Sq	1 Sq		1 Sq
Philippines	2 Sq	2 Sq		1 Sq
Caribbean Defense Command			1 Gp	
Continental United States & Strategic Reserves			13 Gps	
GHQ			1 Gp Photomap (mapping)	

(12 Gps (432 airplanes) for continental U.S. & strategic reserve; 4 Gps for Trans, 4 Sqs for Chem, 4 Sqs for Armored Div.)

3000 (400 of which are in Reserve) 14 Man Gliders, distribution undetermined.

1 Pursuit Group per each Support Command is included among the 4 Pursuit Groups set up for other Latin American and U.S. defense needs.

AIRLIFT REQUIRED TO SUPPORT AIR OUTPUT FOR THE AIR FORCES. (Tab 11)

In order to maintain the services required by the air forces set up in the foregoing using the minimum amount of air transports estimated as essential, there are required 13 Transport Groups (1040 transports, including Depot Reserve to consist of 140 4-engine long range and 880 2-engine medium range transports, all with approximately 30-man capacity).

TRAINING FACILITIES TO BUILD AND TO MAINTAIN THE ARMY AIR FORCES. (Tab 14)

1. The critical element insofar as training of personnel is concerned, consists of the training of pilots requiring to form and to maintain the Air Forces set up above. While the Interim Expedient Air Force is operating, it is estimated that attrition will require the graduation of 85,236 pilots per year. In order to expand our pilot training establishment from the present objective (30,000 graduates per year) to a 85,236 rate, 57 new flying schools will be required.

2. When the ultimate Air Force is organized and the necessity for operations by double combat crews no longer exists, the annual replacement requirement is estimated as 108,528. This rate will require 72 additional flying schools beyond those set up to graduate 30,000 per year.

3. Flying schools to graduate 85,236 per year would be set up immediately upon the approval of this program. These schools would be expanded to the 108,528 rate approximately one year before the ultimate Air Force could be established. It will be noted that this date is indefinite but considerably earlier than the ultimate Air Force would set up under that heading in war as far as the procurement of airplanes is concerned.

REQUIREMENTS IN TRAINING AIRPLANES (Tab 14)

Training airplanes by number and type will be required to produce the numbers of graduated pilots annually, in accordance with the table below:

Operating Training Type Airplanes.

Type	85,236 Graduated Pilots per year for Interim Expedient Air Force	108,528 Graduated Pilots per year for Ultimate Air Force
Primary Trainer	8520	11115
Basic Trainer	8814	11486
Adv. Trainer - 1-Engine	2954	3853
Adv. Trainer - 2-Engine	5736	7484
Bombardment	1988	2594
Observation	341	445
Transport	57	74
TOTAL TRAINING	28400	37051

TIME TO MEET TRAINING REQUIREMENTS.

As a general statement, pilots can be trained prior to the dates that the combat airplanes which the pilots are to operate can be manufactured.

For example, if the necessary numbers of additional Primary Training type airplanes (4195) can be added to those expected to be on hand (4325 plus 4195 equals 8520) on February 15, 1942, it would be possible to start the expanded pilot training schools in operation on May 15, 1942. It would then be possible to man and to meet war time attrition on the Interim Expedient Air Force by November 1, 1943, without interfering with the 54 Group Program. Tab 20 indicates that the date November 1, 1943, is far ahead of the date on which it is possible to manufacture all of the combat airplanes included in the Interim Expedient Air Force.

PERSONNEL REQUIREMENTS. (Tab 16)

To man and to operate Army Air Forces of the size and composition set forth in the foregoing, to operate all training, maintenance and overhead installations necessary therewith, there will be required personnel approximately as follows:

Officers	Interim Expedient	Eventual
Pilots	103,482	90,391
Navigators	21,642	19,866
Bombardiers	7,387	6,126
Observers	3,196	3,196
Total Flying	135,526	121,577
Non-Flying AC	40,798	39,214
Total AC	176,324	160,791
Other Branches	19,355	18,607
TOTAL	195,679	179,398
Enlisted Men		
Technicians AC*	842,439	813,961
Non-Technical AC	614,403	588,247
Total AC	1,476,842	1,302,210
Other Branches	492,395	479,503
TOTAL	1,949,237	1,881,721
GRAND TOTAL	2,144,916	2,061,119

* Approximately one year required for training to degree necessary for operations. Twenty-two new technical schools will be required therefor. These numbers include approximately 60,000 enlisted members of combat crews.

MANUFACTURE OF AIRPLANES. (Tabs 17 and 20)

The numbers of additional factories and the output of airplane factories is determined by the monthly replacement rates required to sustain the Air Forces set forth in the foregoing in war operations. The total number of airplanes of each type which must be built (in addition to current orders) to build and to maintain the Army Air Forces in one year of operations are included in Tab D to the compilation by the Joint Board.

Aircraft Types	INTERIM EXPEDIENT Monthly Replacements Required	ULTIMATE REQUIREMENT Monthly Replacements Required
M/Bomb B-26	286	143
H/Bomb B-17	547	319
H/Bomb B-29	544	273
H/Bomb 4000 mile		501
Dive & Light	98	98
Total Bombardment	1477	1334
Pursuit	576	576
Observation & Photo	121	121
Transport	102	102
GRAND TOTAL	2276	2133

POSSIBILITY TO MANUFACTURE WITHIN REASONABLE TIME. (Tab 20)

It is within the capacity of the nation to implement the Army Air Forces indicated in the foregoing.

An air offensive against Germany can be initiated by a token force of 3 Heavy Bombardment Groups in April 1942.

If an all out effort is initiated immediately, the air offensive against Germany can reach full power in April 1944.

The air offensive against Germany can be sustained at full power.

COMPARISON OF OPPOSING AIR FORCES. (Tab 19)

In operations against Germany, the estimated numerical relationship between the Germany Air Force and the combined strength of the Army Air Forces and the Royal Air Force will be as follows:

	GAF	SUPERIORITY RAF + AAF
July 1, 1943		
Bombers	62%	
Pursuit	22%	
Fighter	90%	
Total Combat	83%	
Mid 1944		
Bombers		15%
Pursuit	22%	
Fighter	90%	
Total Combat	14%	
Ultimate		
Bombers		5%
Pursuit	22%	
Fighter	90%	
Total Combat		11%

The numerical comparison is no true indication of the relative strength of the opposing Air Forces. We now have a superiority in performance in Heavy Bombers and it is proposed to maintain that superiority and win the war by exploiting the superiority of our Heavy Bombers to the utmost.

The grand total Army Air Forces set up in the foregoing is a large force. It is designed to win a large war.

CONCLUSION.

The forces required to accomplish the mission of the Army Air Forces have been computed carefully. They represent the minimum force necessary to succeed in each task. Any reduction in force must therefore include a reduction in task.

For example, if the 25 groups required for the defense of the United States, our possessions and the Western Hemisphere cannot be made available, the task must be reduced to the defense of a specific part of the Hemisphere or of specified possessions.

If the required combat airplanes are manufactured for the Army Air Forces, personnel can be trained to man and to operate those air forces as soon as the combat airplanes can be manufactured.

The Army Air Forces are prepared to accomplish their mission in the defeat of our potential enemies as soon as American aviation industry can manufacture the required airplanes.

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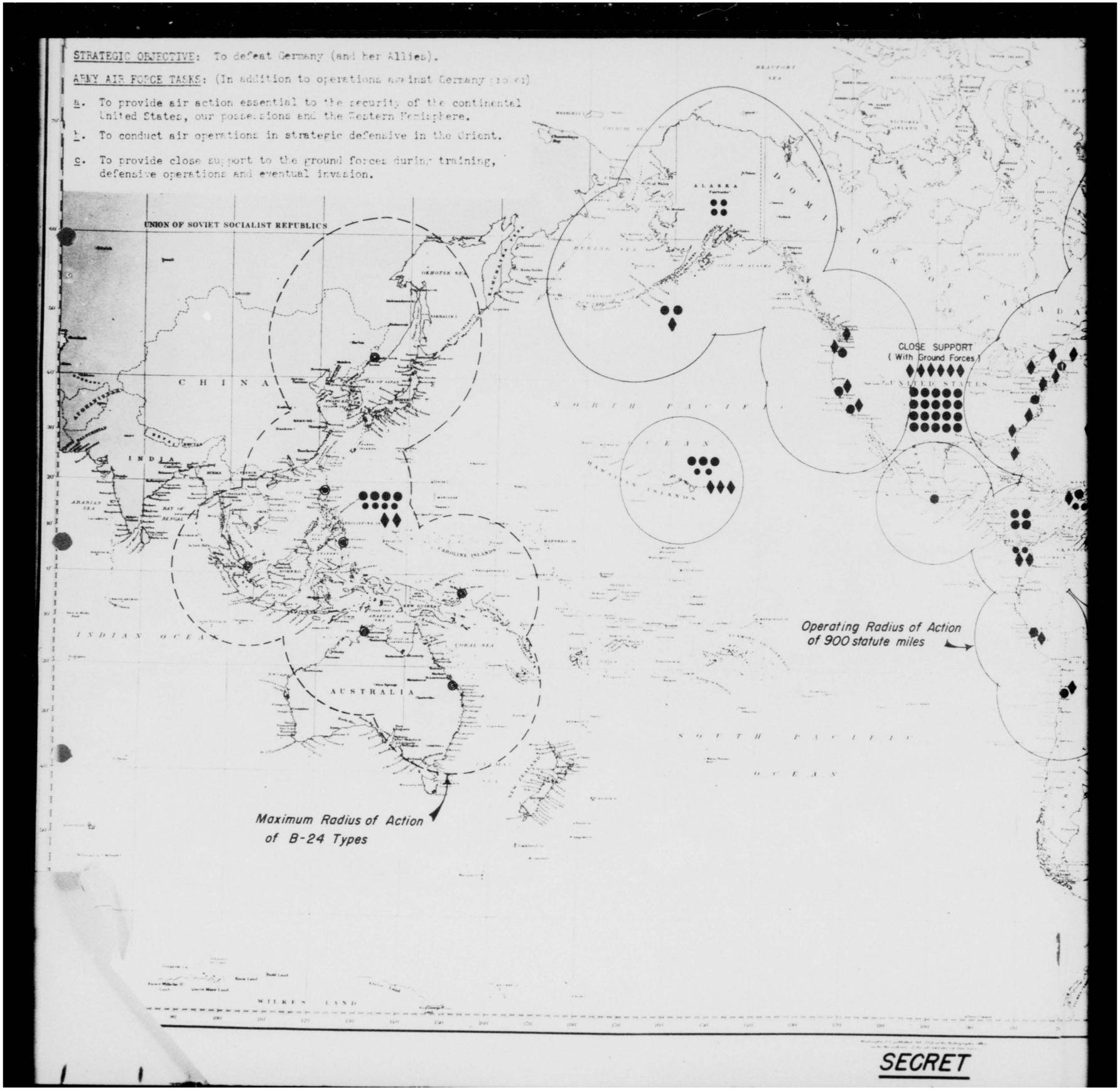

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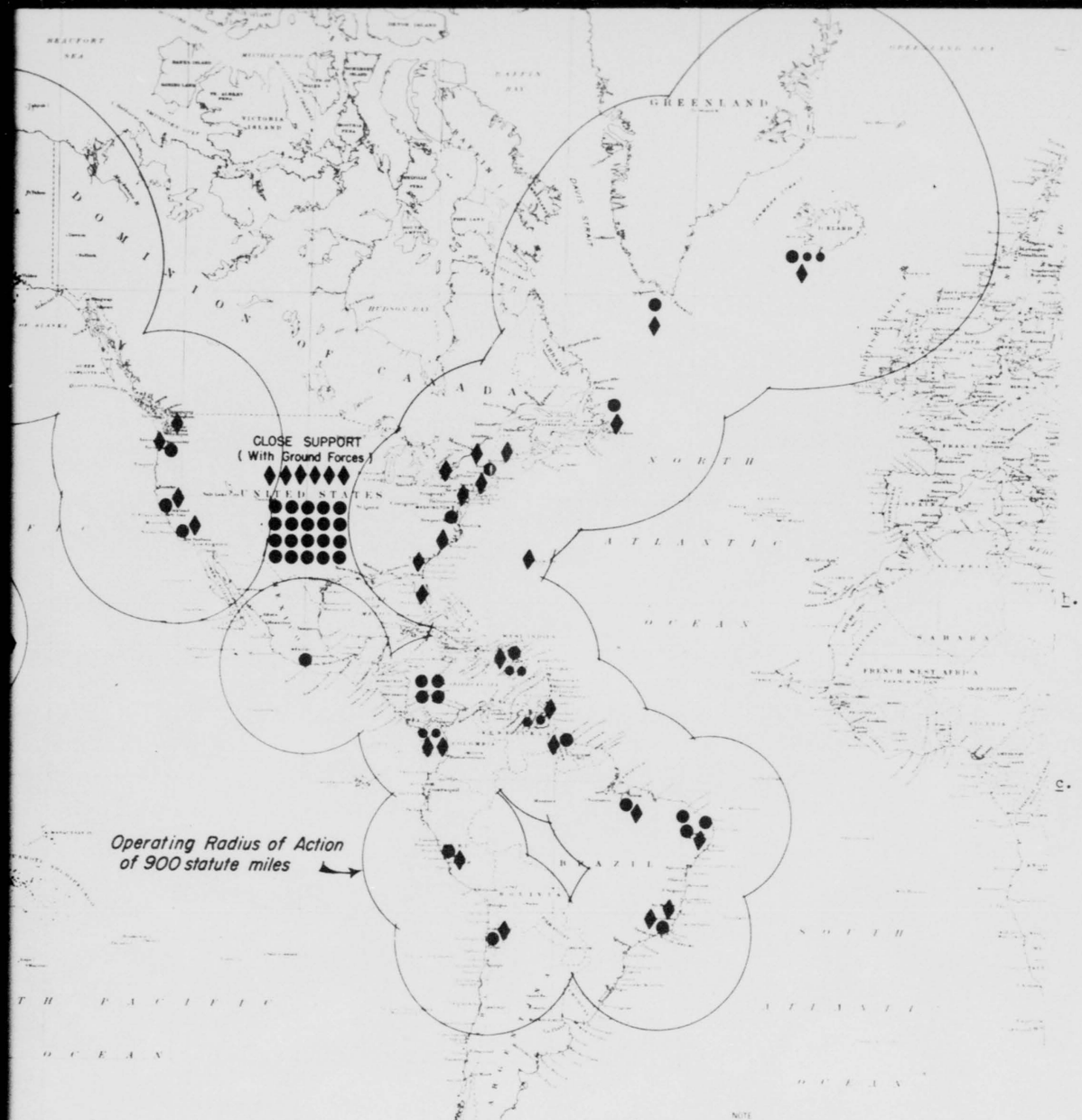

Minimum coverage required to -

(1) Protect vital economic and military obj against carrier, flying deck or land ba attack;

(2) Defend the Pacific Triangle, Alaska and es to the Panama Canal;

(3) Acquire data and information essential f out defense in the event of a forced ret from the European Theatre.

The forces set up are minimum. Note that the include only 5 Bombardment Groups in the cont United States and that coverage in South Amer very thin.

Pursuit forces are set up to provide limited d over the areas indicated and to defend bombard bases.

Total Force Required:

Bombardment - 25 Grs 1700 Airplanes (Not inclu Depot Rese

Pursuit - 32 Grs 4160 Airplanes (Not inclu epot Rese

In addition to these units, 9 Groups of Heavy B bardment must be available as general reserve u maximum output of airplanes and pilots is ob

b. Strategic Defensive in Orient. The forces set solely for the defense of the Philippines inclu heavy bombardment groups, are to be augmented b additional heavy bombardment groups and 1 pursui group. This augmented force can operate against northern approaches to the China Sea and from t bases indicated in the map should go far toward covering the Japanese from any offensive operat in the Orient.

c. Close Support. The support forces set up are th re- irement of the ground force establishment se forth in Tab D to the Joint Board estimate.

(1) Total Support Force Required:

Light Bombers	-	13 Grs	750* airplanes.
Div Bombers	-	13 Grs	1004 airplanes.
Pursuit	-	6 Grs	450 airplanes.
Observation	-	108 Sqs	1521 airplanes.
Transport	-	19 Grs	1214 airplanes) For 10
Gliders	-	15 Men	2400)Force
			)sions
			)Parach
			)Battali

* (Not including Depot Reserve)

NOTE
The boundaries shown upon this chart are approximate only and should not be regarded as having official significance.

LEGEND

- Bombardment, Group (any type)
- Bombardment, Squadron (light or dive)
- Pursuit, Group

NOTE: All Army Air Force Units (excluding those conducting the offensive against Germany proper) - are included on this map except

108 Observation Squadrons (with Armies, Corps, and Armored Divisions)
32 Transport Groups (19 with Ground Forces, 13 with Air Forces)
2 Photo-Mapping Groups (with GHQ)

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(1) Protect vital economic and military objectives against carrier, flying deck or land based air attack;

(2) Defend the Pacific Triangle, Alaska and approaches to the Panama Canal;

(3) Acquire data and information essential for all out defense in the event of a forced retirement from the European Theatre.

The forces set up are minimum. Note that the forces include only 5 Bombardment Groups in the continental United States and that coverage in South America is very thin.

Pursuit forces are set up to provide limited defense over the areas indicated and to defend bombardment bases.

Total Force Required:

Bombardment - 25 Gps 1700 Airplanes (Not including Depot Reserve)

Pursuit - 32 Gps 4160 Airplanes (Not including Depot Reserve)

In addition to these units, 8 Groups of Heavy Bombardment must be available as general reserve until maximum output of airplanes and pilots is underway.

b. Strategic Defensive in Orient. The forces set up solely for the defense of the Philippines include 2 heavy bombardment groups, are to be augmented by 2 additional heavy bombardment groups and 1 pursuit group. This augmented force can operate against the northern approaches to the China Sea and from the bases indicated in the map should go far toward discouraging the Japanese from any offensive operations in the Orient.

c. Close Support. The support forces set up are the requirement of the ground force establishment set forth in Tab D to the Joint Board estimate.

(1) Total Support Force Required:

Light Bombers	-	13 Grs	757* airplanes.
Dive Bombers	-	13 Grs	1094 airplanes.
Pursuit	-	6 Grs	450 airplanes.
Observation	-	109 Sqs	1521 airplanes.
Transport	-	19 Grs	1215 airplanes) for 10 Air
Gliders	-	16 Men	2400)borne divi-
			)sions & 24
			)Parachute
			)Battalions.

* (Not including Depot Reserve)

NOTE
The boundaries shown upon this chart are approximate only and should not be regarded as having official significance

LEGEND

● Bombardment, Group (any type)

• Bombardment, Squadron (light or dive)

♦ Pursuit, Group

NOTE: All Army Air Force Units (excluding those conducting the offensive against Germany proper) are included on this map except

108 Observation Squadrons (with Armies, Corps, and Armored Divisions)
32 Transport Groups (19 with Ground Forces, 13 with Air Forces)
2 Photo-Mapping Groups (with GHQ)

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J.B. No. 355
(Serial 707)

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SECTION II, PART III, APPENDIX II

ULTIMATE REQUIREMENTS AIR FORCES - SUPPORTING STUDY

INDEX OF TABS

TABS

1. Tabulation of Total Aircraft Requirements.
   (a) Map — Disposition of Combat Air Units.

2. Air Intelligence — Estimate of the Situation.
   (a) Map — Principal Targets Air Offensive against Germany.

3. Army Air Force Bombardment Operations against Germany.
   (a) Tabulation of Bombardment Force Required.
   (b) Basis for Calculation of Force Required to Destroy Targets.

4. Escort Fighters.

5. Bombardment Bases for Operations against Germany.
   (a) Airdromes in United Kingdom and Middle East.
   (b) Map — Sphere of Action, 4,000 Miles Radius Airplane.

6. Army Aircraft Required for Control of the Seas (Operations in Support of and in Lieu of the Fleet).

7. Bombardment Aviation Required for Hemisphere Defense.
   (a) Map — Hemisphere Defense, Bases and Operating Radii (B-17 and B-24).

8. Bombardment Aviation Required for Strategic Defense in Asia.

9. Pursuit Requirements — Total.
   (a) Pursuit Requirements to Support Air Offensive against Germany.
   (b) Pursuit Requirements for Hemisphere Defense.
   (c) Pursuit Requirements for Strategic Defensive in Asia.
   (d) Pursuit Requirements for Support of Ground Forces.

10. Air Support Aviation Required for Support of Ground Forces.

11. Transport Aviation Required to Maintain Aerial Lines of Communication.

12. Pilot Training Requirements (Flying Schools and Training Airplanes.)

13. Personnel Requirements.

14. Aircraft Production Program.

15. Flying Weather — All Theaters.

16. Chart — Comparison of Hostile Air Forces.

17. Production Requirements for Heavy Bombers — Discussion.
   (a) Chart — Monthly Production Rates - Heavy Bombers.
   (b) Chart — Rate of Activation of Heavy Bombardment Gps.

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(Serial 707)

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TAB 1

TABULATION OF TOTAL AIRCRAFT REQUIREMENTS

(Consolidated)

Aircraft Types	Total Airplanes (including 25% Reserve)	Monthly Replacement Rate	Anticipated on Hand July 1, 1943 Present Schedule (Tab 14)
Bombardment			
(4000 mi. rad.	(3740)*	(501)*	0
(H & M)	7097	1379	7550
(Dive & L)	2201	90	
Pursuit	8775	576	7700
Obsn. & Photo.	2043	121	350
Transport	2560	102	1140
TOTAL COMBAT	22676	2276	16740
	(26416)*	( )**	
Training	37051 (See page 4 this Tab)		15100
	59727		31840***
	(63467)*		

* The eventual strength and composition of the Army Air Force required to accomplish the mission includes 4000 mile radius of action bombardment airplanes. Pending the manufacture of these airplanes in tactical quantities, double combat crews are to be employed in operations against Germany in the shorter range airplanes (heavy and medium bombardment) as an undesired expedient. The strength and composition of this interim expedient Air Force are indicated by the figures not in parentheses.

** When sufficient numbers of 4000 mile radius of action bombardment airplanes are on hand, the replacement rate of heavy and medium bombardment types will be reduced almost 50%, the expedient necessity for double combat crew operation having been eliminated.

*** This total has been reduced from the figure 43320 airplanes (given as the total of Army production shown in the exhibit "Aircraft Production Program"-Tab 14) by the losses estimated during the period until July 1, 1943.

(Tab 1, Exhibit II, Part III, AP 340IX II).

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S E C R E T

DETAILS OF AIR UNITS BY TYPE

BOMBARDMENT

Aircraft Type	Total Grps	Total Sqs	Combat Sqs	Opn Tn Sqs	No. Sq	Op. Acs	25% Res. in Acs	No. Repl. in Acs	Cross Ref's
Offensive against Germany									
M/B B-25									
26 types	10	60	40	10	10	850	212	286	Tab 3
H/B B-17									
24 types	20	120	80	20	20	1360	340	456	Tab 3
H/B B-29									
32 types	24	144	96	24	24	1632	408	546	Tab 5(a)
H/B 4000 mile rad*	(44)	(264)	(176)	(44)	(44)	(2992)	(748)	(501)	Tab 5(a) (Par 6)
TOTALS	54	324	216	54	54	3842	960	1288	
Hemisphere Defense									
H/B B-17									
24 types	23	138	92	23	23	1564	391	46	Tab 7
Strategic Defense in Asia									
H/B B-17									
24 types	4	24	16	4	4	272	68	45	Tab 8
Recapitulation-Total Bombardment by Types									
M/B	10	60	40	10	10	850	212	286	---
H/B B-17									
24 types	47	282	188	47	47	3196	799	547	---
H/B B-29									
32 types	24	144	96	24	24	1632	408	546	---
H/B 4000 mile rad*	(44)	(264)	(176)	(44)	(44)	(2992)	(748)	(501)	---
GRAND TOTAL U.S. & U.K. BOMBERS									
ALL TYPES	81	486	324	81	81	5678	1419	1379	

* H/B 4000 mile radius of action not included in totals.

DIVE & L. ...IGHT BOMBERS

Bombers for Air Support Commands									
M/B A-20	13	65	39	13	13	757	189	42	Tab 10
Dive Bomb.	13	65	39	13	13	1004	251	56	Tab 10
TOTALS	26	130	78	26	26	1761	440	98	

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PURSUIT

Aircraft Type	Total Gps	Total Sqs	Combat Sqs	Opn Tn Sqs	Hq Sq	Op. Acs	25% Res. in Acs	No. Repl. in Acs.	Part Tabs
Offensive vs Germany									
Inter. Day		(84	63		21	2205	551	334	Tab 9
Inter. Night	21*	(21	21	21	-	525	131	80	Tab 9
TOTAL	21	105	84	21	21	2730	682	414	

* Only 16 of these groups can be accomodated initially in England and Suez. Five (5) groups initially will be located in the Western Hemisphere.

Hemisphere Defense									
Inter. Day		(124	93		31	3255	814	96	Tab 9
Inter. Night	31	(31	31	31	-	775	194	23	Tab 9
Fighter Long Range	-	-	-	-	-	-	-	-	
TOTAL		125	124	31	31	4030	1008	121	

Reserve for Ground Forces — Tab 10

Inter. Day / Inter. Night / Fighter Long Range: Six Pursuit Groups, in Strategic Reserve in the U. S., are included in Hemisphere Defense totals. Five of these groups are allocated initially to air support commands.

Strategic Defense in Asia									
Inter. Day		(8	6		2	210	53	33	(
Inter. Night	2	(2	2	2		50	12	8	(Tab 9(c)
Fighter Long Range	-	-				-	-	-	
TOTAL	2	10	8	2	2	260	65	41	

(TAB 1, SECTION II, PART III, APPENDIX II).

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(Serial 707)

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Aircraft Type	Total Gps	Total Sqs	Combat Sqs	Opn Tn Sqs	Hq Sq	Op. Acs	25% Res. in Acs.	Mo. Repl. in Acs.	Part Tabs
Recapitulation-Total Pursuit by Types									
Inter. Day	54	(216	162	54	54	5670	1418	465	---
Inter. Night		(54	54			1350	337	111	---
Fighter Long Range	-					-	-	-	
TOTAL	54	270	216	54	54	7020	1755	576	
GRAND TOTAL PURSUIT ALL TYPES	54	270	216	54	54	8775		576	

TRAINING

Bombardment (Combat type - allocated to schools	2594	Airplanes
Transport	74	"
Primary Training	11115	"
Basic Training	11486	"
Advanced Training - 1 Engine	3853	"
Advanced Training - 2 Engine	7484	"
Observation	445	"
TOTAL	37051	"

Observation for Air Support Command.

PHOTO & OBSERVATION

Aircraft Type	Total Gps	Total Sqs	Combat Sqs	Opn Tn Sqs	Hq Sq	Op. Acs.	25% Res. in Acs.	Mo. Repl. in Acs.	Pert. Tabs
Observation		108	108			1521	380	98	Tab 10
Photo	2	10	8		2	114	28	23	Tab 10
TOTAL	2	118	116		2	1635	408	121	

TRANSPORT

Maintenance Command	13	65	52	0	13	832	208	25	Tab 11
Ground Troop Training	19	95	76	0	19	1216	304	77	Tab 10
TOTAL	32	160	128	0	32	2048	512	102	

TOWED GLIDERS

15 Man Gliders						2400	600	153	

(TAB 1, SECTION II, PART III, APPENDIX II).

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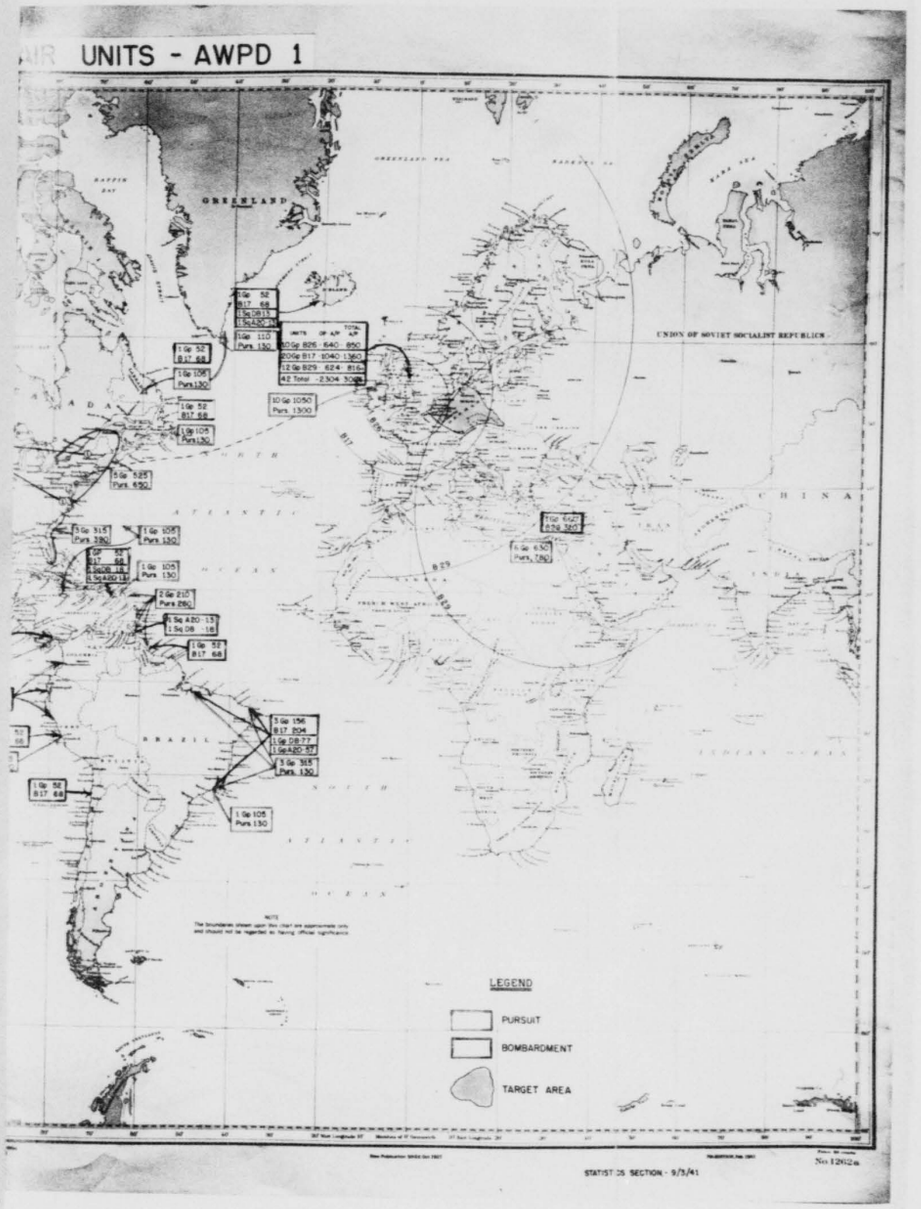

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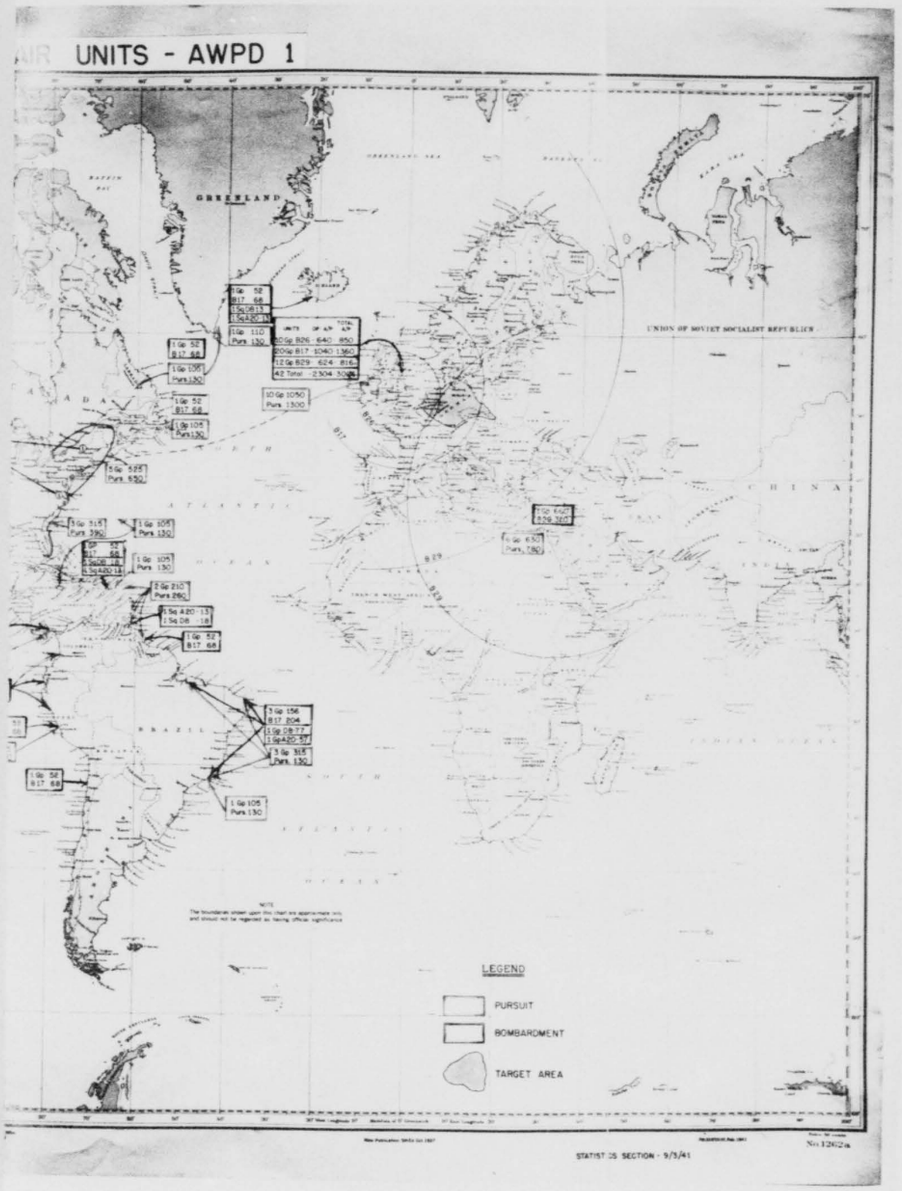

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(Serial 707)

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TAB 2

AIR INTELLIGENCE - ESTIMATE OF THE SITUATION

1. National Mission:— a. To defeat our potential enemies. (Letter from The President to the Secretary of War, 9 July 1941).

b. The broad strategic objective (object) is, in conjunction with Great Britain and her allies, to defeat Germany and her allies (United States-British Staff Conversations Report, ABC-1).

c. This plan is based upon the conception that Germany should be decisively defeated first, and that her allies, including Japan should be decisively dealt with after that aim has been reached.

2. Air Mission:— a. To wage a sustained air offensive against German military power, supplemented by air offensives against other regions under enemy control which contribute toward that power (ABC-1).

b. To support a final offensive, if it becomes necessary to invade the continent.

c. In addition, to conduct effective air operation in connection with Hemisphere Defense and a strategic defensive in the Far East.

3. Situation:— a. The center of Axis system is in Germany. Hence, that is where pressure must be applied ultimately. Italy has been relegated to a position of secondary importance.

b. The German offensive against Russia and the other German war operations have placed a considerable strain upon the economic structure of the Reich, and the Russian Campaign engaged a major portion of the Germany army and most of the German Air Force in Eastern Europe.

c. The declaration of war by Germany against Russia improved the conditions for enforcing the sea blockade and the means of applying pressure through economic warfare. Even in the event of Russian collapse, the German economic structure will continue to operate under heavy strain, and there will be a period of at least a year before Russian economy could be resusicated and incorporated into the German system.

d. The extent of the economic strain on Germany is indicated by the following: at present there are 6½ million men under arms in the German army, 100,000 in the German Navy, and 1½ million in the German Air Force. Behind this armed front, there are 8½ million men engaged in armaments works alone, about half of whom are working in steel industries. Nearly 17 million men are directly engaged in this war, to the exclusion of all normal civil pursuits and production. Hence, there is a very heavy drain on the social and economic structure of the state. Destruction of that structure will virtually break down the capacity of the German nation to wage

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war. The basic conception on which this plan is based lies in the application of air power for the breakdown of the industrial and economic structure of Germany. This conception involves the selection of a system of objectives vital to continued German war effort, and to the means of livlihood of the German people, and tenaciously concentrating all bombing toward destruction of those objectives. The most effective manner of conducting such a decisive offensive is by destruction of precise objectives, at least initially. As German morale begins to crack, area bombing of civil concentrations may be effective.

c. It is improbable that a land invasion can be carried out against Germany proper within the next three years. If the air offensive is successful, a land offensive may not be necessary. Our air bases in England and elsewhere must be made secure, primarily by ground forces, and the lines of communication by sea must also be made secure.

4. a. Possible Lines of Action. Based on an analysis of military and economic factors, the following lines of action for an air offensive can be set up for consideration.

(1) Lines of action whose accomplishment will accomplish the air mission in Europe.

(a) Disruption of a major portion of the Electric Power System of Germany.

(b) Disruption of the German transportation system.

(c) Destruction of the German oil and Petroleum system.

(d) Undermining of German morale by air attack of civil concentrations.

(2) Lines of action representing intermediate objectives, whose accomplishment may be essential to the accomplishment of the principal objectives listed above.

(a) Neutralization of the German Air Force.
(1) By attack of its bases.
(2) By attack of aircraft factories (engine and airframe).
(3) By attack of aluminum and magnesium factories.

(3) Lines of action representing diversion objectives, which may be forced upon us by the necessity for assisting in maintaining the security of bases.

(a) Attack of submarine bases.
(b) Attack of surface sea craft.
(c) Attack of "invasion" bases.

(TAB 2, SECTION II, PART III, APPENDIX II).

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5. Discussion of Possible Lines of Action.

a. Electric Power. Nearly all industry, civil as well as military, finds its roots in electric power. The German electric power system, the second largest in the world, was greatly expanded for this war. Even so, it is operating at 50% greater rate than the British electric power system today. It is vital to the German war effort, and is highly important to civil life. Following are some of the industries dependent upon electric power:

Aircraft manufacture
Aluminum production (which absorbs 10% of all public power)
Synthetic rubber production (a critical item. Two plants provide nearly 1/2 production).
The textile industries (an important item in view of the shortage of wool and warm clothing in Germany).
All the armament industries, involving the production of guns, great quantities of shells, and tanks.
Shipbuilding industry.
The automotive industry.
Cold storage of food.
Urban transportation.

The electric power industry is closely integrated into a "power grid". However, the careful selection of major power stations and switching stations and their destruction would make it possible to isolate the principal manufacturing and population centers from their sources of electric energy. The targets involved are small, but readily distinguishable in daylight. They are susceptible to destruction by bombs, but many hits are required. They vary in distance from 400 to 1,000 miles from England. They are precision targets. A typical plant covers an area about 500 ft. x 300 ft. The British estimate that about 17 hits in that area will guarantee destruction of the plant. It is estimated that the destruction of about 50 power plants will reduce the total capacity to about 60% of the present total. However, by destroying selected switching stations this number might be reduced to about twenty, and the industrial power to key manufacturing centers be almost completely shut off. Eighty percent of electric power consumed in Germany is utilized by industry. 50 targets are set up for this task. See Map - Principal Targets Air Offensive against Germany. Tab 2(a).

b. Transportation. In anticipation of this war, Germany has deliberately dispersed critical industries as much as possible. However, this has made transportation even more vital than would normally be the case. The German Transportation system is carrying an extremely heavy load, divided about as follows:

Railroads	72%
Waterways	25%
Long haul truckage	3%

(TAB 2, SECTION II, PART III, APPENDIX II).

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(1). Railways.-- The German railways are working at capacity. They are dependent upon a highly complex system of marshalling yards. The great majority of railroad traffic enters or leaves the Ruhr, which is virtually the manufacturing center of the heavy industries. 70% of the steel industry is concentrated there.

(a). Marshalling Yards.-- It is estimated that about eight marshalling yards handle almost all of this traffic to the Ruhr. These marshalling yards are only about three hundred and fifty miles from England. They are area targets. The yards themselves are not particularly vulnerable to air attack. Traffic may be seriously delayed, but the damage to tracks is fairly easily repaired. Hence, they must be subjected to repeated attacks. It is estimated that disruption of the marshalling yards of the Ruhr for 24 hours sets back the production of the Ruhr about two weeks. Considering the rail net as a whole, it is believed that repeated attacks upon fifteen marshalling yards would cause such traffic confusion as to break down the operating system. In addition, there are important railroad bridges across such major waterways as the Rhine, the Elbe, and the Oder. These bridges are difficult to replace, even with temporary structures. They represent rather small precision targets. Repeated attacks are necessary to prevent replacement with temporary structures.

(b). A total of 30 targets is set up for the railroad transportation system.

c. Inland Waterways.-- (1). The German transportation system is vulnerable through the inland waterways because of 2 factors:-

(a). The waterways carry 25% of the total freight transported in Germany.

(b). The railroads are already taxed to capacity, and could not stand up under a 25% increase.

(2). The vulnerability of the inland waterway system to air attack arises from the fact that the destruction of an estimated 14 targets would neutralize the effectiveness of the east-west canal system of Germany. These 14 targets consist of 3 ship elevators, locks at 9 points, and the inland harbors at Mannheim and Duisburg. (See Map: Principal Targets Air Offensive against Germany - Tab 2(a)). The purposes of the German Inland Waterways are twofold:-

(a). To relieve the railroads in time of emergency of the slow, bulky freight such as coal, ore, agricultural products, etc., etc.

(b). To bring the Ruhr coal and Sigerland iron products to central and Southeastern Germany. (areas of the strategically relocated German industry - Hermann Goering Works, Volkswagan Plant, gasworks at Magdeburg-Rothensee) by a cheap water route.

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(3) The main continuous stretch known as the Central German Canal, starting with Duisburg on the Rhine and ending at Plauer near Berlin, is about 330 miles long. The canal has 54 locks and double locks, 3 ship elevators, 23 pumpworks, 29 water overflow facilities, 21 high water entires, 27 safety locks, 11 canal bridges, 454 tunnels underneath canals, 110 railway bridges, 6 highway bridges, 636 street bridges, 9 railway and street tunnels, and 8 pipe bridges.

(4). In 1943 the Rhine-Main-Danube canal system will be completed. Broadly speaking; the purpose of this system is to connect the North and Black Seas by a continuous inland waterway. The completion of this system will increase the number of targets beyond those which have been selected on the existing system. Three targets have been set up for this increase.

(5). The seasonal factor should be given careful consideration in any final plan of operations against the German inland waterways system, inasmuch as the canals are frozen over for a considerable period in the winter and traffic fluctuates widely at other seasons of the year; reaching a peak in the late fall. The greatest effect would be secured by an attack on the canal system at the time of greatest traffic, i.e. in the last summer and fall seasons.

(6). In addition to the effect upon war industry, crippling of the German transportation system would bring severe suffering to the German people by denying them the necessary coal for heating. The winters in Germany are cold and clothing is becoming scarce. Breakdown of the transportation system would interfere with the orderly distribution of food-stuffs and common utilities.

(7). Canal locks and ship elevators are precision targets. They are easy to locate and vulnerable to destruction by bombing. Their destruction would have an immediate effect, and a relatively permanent one.

(8). The importance of transportation is emphasized by the fact that 70% of steel production is in the Ruhr, and 2/3 of the iron ore for steel production must be transported into Germany from outside sources.

d. Summary of Transportation targets:

Railway		
Marshalling yards	15	
Bridges over the Rhine, Oder and other sensitive points	15	
Total	30	
Inland Waterways		
Ship elevators	3	
Locks and harbor works	11	(existing)
Targets	3	(new canal)
Total	17	

(TAB 2, SECTION II, PART III, APPENDIX II).

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e. Petroleum and Synthetic Oil.--(1). German transportation, the German Air Force, the German Navy, and German industry all are dependent upon oil. The amount of oil in storage in Germany before the war is not known. The present German production and importation of oil and the production of synthetic oil and gasoline is believed to be capable of meeting current expenditures.

(2). About 60% of aviation gasoline comes from synthetic production in Germany proper. Eighty per cent of this production come from 27 plants. These plants vary from 400 to 1,000 miles from England. They are easily distinguishable in daylight, and they are susceptible to destruction by bombing. They are precision targets.

(3). About 22% of the oil for aviation gasoline comes from Rumania. It is refined in Rumania and is moved primarily by water transportation up the Danube to Germany. Success in the oil venture might necessitate operating against the Danube to stop this flow. Hence, the importance of retaining bases in Asia Minor or Syria.

(4). Russian oil, if procurable by Germany, must also move across the Black Sea by water transportation, which might be disrupted by air attack in this theater.

(5). Synthetic oil plants resemble ordinary petroleum refineries, and both are vulnerable to destruction by bombing. They are large targets, easily distinguishable, and they are hard to replace. However, they should not be considered area targets. The most vital element of each plant should be determined and bombing should be concentrated against that point. Near misses and normal bombing distribution will contribute to destructive effect required.

(6). Number of targets set up for this task: 27.

f. Morale. Timeliness of attack is most important in the conduct of air operations directly against civil morale. If the morale of the people is already low because of sustained suffering and deprivation and because the people are losing faith in the ability of the armed forces to win a favorable decision, then heavy and sustained bombing of cities may crash that morale entirely. However, if these conditions do not exist, then area bombing of cities may actually stiffen the resistance of the population, especially if the attacks are weak and sporadic. Hence, no specific number of targets is set up for this task. Rather it is believed that the entire bombing effort might be applied toward this purpose when it becomes apparent that the proper psychological conditions exist.

6. Intermediate Objectives.

a. German Air Bases. One way to insure the feasibility of precision bombing attacks upon the Principal Objectives would be through the destruction of the German Fighter Forces. However, the Germans have been at great pains to provide adequate air bases for their forces. It is estimated that there

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are approximately 500 bases in Western Germany and the occupied territories. They are provided with exceptionally strong light "flak" defenses. Aircraft are dispersed, generally about a mile from the landing areas for the bombers, less for the fighters. Each airplane is provided with individual protection in the form of a revetment and concrete taxiways are provided. Quarters for personnel are scattered through neighboring villages. The whole system is carefully camouflaged. Incidentally, the German air bases are far superior to the bases of the R.A.F., from the standpoint of security. It seems improbable that the German Fighter Command can be neutralized by air attack of its bases. However, further analysis will be made.

b. Present and Projected Strength in Aircraft:

	Present Strength (7/1/42)	Projected Strength to 7/1/43
Estimated Plane Strength		
Operational Combat	9,847	9,250
Total in Air Fleets	14,835	18,900
Sum total of all types	36,320	57,705
Estimated Pilot Strength	48,500	69,500
Estimated total monthly losses	1,800	2,945

(1). The above figures for 7/1/43 were arrived at by a continuation of curves representing past growth of productive capacity and losses. It is not believed that the figures estimated by this method are possible of attainment by Germany, due to various difficulties of production, notably a lack of skilled labor, various essential materials, transportation difficulties and other factors. Hence; the gain in German air force strength in planes between today and 7/1/43 as estimated by extension of curves has been arbitrarily reduced by 50 percent, giving the estimate shown below:

Estimated Strength German Air Force, 7/1/43.

	Total Operational Combat Planes	Total in Air Fleet Planes
Bombers	3,667 (including 500 long range type)	7,245 (including 800 long range type)
Dive Bombers	1,007	2,075
Pursuit (1 E)	2,001	4,092
Fighters(2 E)	959	1,972
Total	7,534	15,384

It is estimated that of the bombers shown above, 500 of the Total Operational Combat and 800 of the Total in Air Fleet, will consist of long range types. (Over 1000 miles radius of action.)

(G-2, SECTION II, PART III, APPENDIX II).

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(2). It is estimated that the total number of airplanes in the German Air Force, including transport, training types, army cooperation, and a depot reserve equal to 100% of Air Fleet airplanes will on 7/1/43 amount to approximately 45,000 planes. The achievement by Germany of this estimate is, of course contingent upon the availability of all essential materials, skilled labor, and other elements of production necessary to complete the job.

c. German Aircraft Factories. The Germans have concealed most of their new factories, and have dispersed them. Also the manufacture of parts and assemblies has been widely decentralized. However, the older plants are still being used as assembly plants, and their location is well known. They are from 500 to 700 miles from England. They really represent area targets, or areas of precision targets. They are not so susceptible to bombing as had been anticipated, as factory bombing is apt to result in less damage than had been estimated. However, adequate forces of bombers should be capable of seriously reducing production, if used in quantity and for considerable periods of time. The number of targets presented can be readily determined, but is not immediately available. The effect of bombing aircraft factories would not be felt immediately, as it is estimated that the Germans had about 100% reserves in storage at the beginning of the Russian campaign. The eighteen principal assembly plants have been selected as targets.

d. Aluminum and Magnesium Plants. Aluminum plants are highly essential to aircraft production, and are concentrated into a small number of objectives. Aluminum production in Germany has been increased from 175,000 tons yearly in 1938 to about 300,000 tons at this time (September, 1941). This increase has taken the form of plant expansion of existing facilities, and six plants produce about 90% of the aluminum. These plants are located from 400 to 800 miles from England. They are precision targets requiring large destruction effort. The time factor would provide some delay in producing effective results, but sooner or later the effect would be catastrophic to the aircraft industry. Aluminum is now being used to replace fittings normally made of copper. This is the result of a critical shortage of copper. Magnesium is equally concentrated, but the quantity of magnesium is appreciably less than that of aluminum required. Six aluminum and six magnesium plants have been selected as targets.

7. Diversion Objectives.-- Threats to the security of the British Isles may make it mandatory to employ bomber forces against submarine bases, invasion ports, and surface raiders. However, these targets represent a diversion from the true objective. It is believed best to avoid such commitments altogether, if possible, leaving this employment to the British bomber force, except in actual emergency.

8. Nature of Opposition to be Encountered.-- The question "Is it feasible to make deep penetrations into German territory and conduct precision bombing without prohibitive losses?" is vital to any consideration of a decisive air offensive in this

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war. Following is a very general discussion of German air defenses:

a. Fighters:— (1). Up until the appearance of the British Sterling bomber and the American Flying Fortress, the German fighters have made daylight bomber operations excessively expensive. Interceptions are the rule, not the exception. The Germans are now known to be using a radio means of detecting and tracking aircraft. They also have a well organized system of ground observers. The German fighters are armed with 20 mm cannon and .30 calibre machine guns. The Germans are producing a 15 mm machine gun with a high rate of fire.

(2). It is difficult to analyze the disposition of the German fighter defenses. There appear to be wide gaps in the defenses. Practically all the defenses have been pushed far forwa d, leaving the interior of Germany practically undefended. However, it is probable that these defenses would be promptly reorganized if penetrations in daylight become more prevalent.

.(3). The German night fighter defenses are rapidly improving. One method of operation is in connection with a band of searchlights which is continuous from the Danish border for about 150 miles to the South. It is about 20 miles deep. Engagements with the night fighters is rapidly becoming the general rule. However, there appears to be a limit to the number of fighters which can operate by radio control in any sector. The Germans are using ME 110 and converted JU 88 fighters for this work, armed with cannon. There appear to be few night fighters in the interior of Germany.

(4). The British Sterling and American B-17 bombers provide a means, at least for the moment, of copying with day fighters. The B-17's rely upon speed, altitude, and deception. However, they have been intercepted, and each time the ME 109's were capable of flying above them and of overtaking them. It is apparent that the B-17 will need defensive fire power. At least one Sterling squadron seems to be solving the problem by fire power. It has lost two airplanes, and has shot down 22 German fighters. The Sterling has a 4-gun power turret in the tail and a 2-gun turret above and another in the nose.

(5). In the penetration of good defenses, it is apparent that all means of protection must be used. Speed is highly important because it limits the number of attacks that may be encountered in a deep penetration and also limits the maneuver of the fighter for attack and the avenues of attack; altitude is highly important for the purpose of evading fighters, and also limiting their maneuver in combat; defensive fire power and armor are essential to stand off attacking fighters (the British are considering reducing their bomb loads by as much as 3,000 lbs. to get better armor and fire power); an escort defensive fighter to accompany bomber formations to close off the rear avenue may be necessary; and simultaneous penetration of defenses at many places in great numbers may offer tactical success. Reliance is still put on defensive formations, although the best size of such formations for large aircraft may be as little as three airplanes. Training of

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gunners is recognized as absolutely essential to deep penetration of defenses.

9. Artillery Defenses

a. The German antiaircraft defenses are extremely good, and are still improving. They are widely scattered throughout Western Germany and the occupied countries, and are highly mobile. It is necessary for bombers to keep maneuvering to avoid being shot down, even at 18,000 feet. The Germans use radio predictions, and fire with amazing accuracy, even though an overcast. It is believed that the effectiveness of antiaircraft fire would be reduced by increasing the number of aircraft making simultaneous approaches to the objective, so as to present simultaneously a maximum number of separate targets.

b. Consideration of all these factors leads to the conclusion, that by employing large numbers of aircraft with high speed, good defensive fire power, and high altitude, it is feasible to make deep penetrations into Germany in daylight. It is believed that the degree of reliability of conducting sustained offensive air operations would be greatly enhanced by development of an escort fighter.

10. Support of a Final Offensive With Invasion of the Continent.

a. Success in the air offensive against the objectives outlined above might cause a collapse of the German government. However, in the event that such an air offensive is not conclusive, it will be necessary to invade the continent. In any event, the threat of such an invasion must be emphasized.

b. The targets listed for the air offensive continue to be appropriate as bomber objectives in this final phase. In addition targets of opportunity in the combat zone and on the battlefield will be revealed as the situation progresses. At that time, all or a part of the bomber forces available can be thrown against such targets. It is not feasible to select such targets now.

11. SUMMARY.-- It is believed that the destruction of the following objectives will result in the maximum contribution of the air offensive toward defeat of our enemies in Europe.

a. Isolate principal industrial and population centers from their sources of electric power:
50 Targets - Precision

b. Disrupt German system of transportation:
30 Rail Targets
17 Waterway Targets

c. Destroy the major sources of petroleum and synthetic oil:
27 Precision Targets

(TAB 2, SECTION II, PART III, APPENDIX II).

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d. Conduct direct attacks against morale, after it begins to crack from other strain.

e. Neutralize the German Air Force by air attacks on:
Assembly Plants - - - 18 targets, precision
Aluminum Plants - - - 6 targets, precision
Magnesium Plants- - - 6 targets, precision

(TAB 2, SECTION II, PART III, APPENDIX II).

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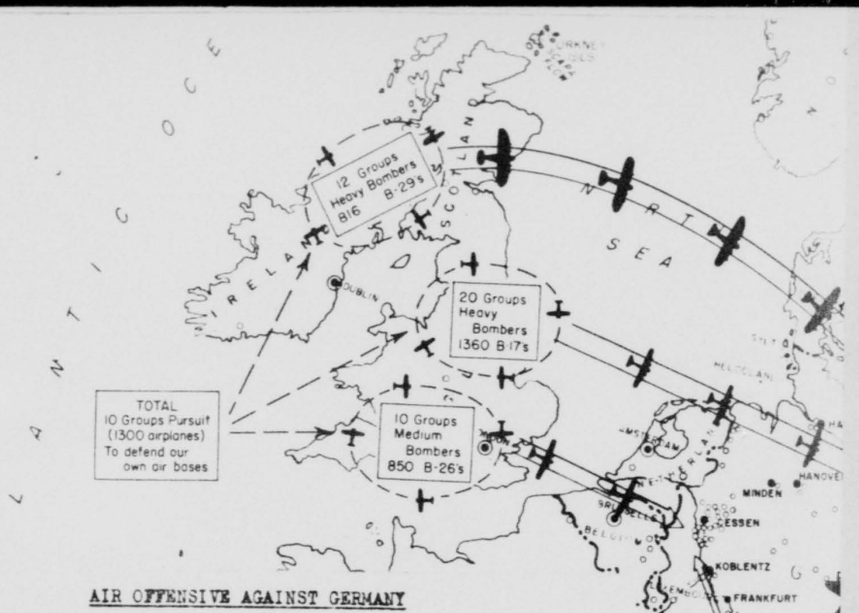

AIR OFFENSIVE AGAINST GERMANY

(Army Air Forces' Munitions Requirements to Defeat our Potential Enemies.)

STRATEGIC OBJECTIVE: To defeat Germany (and her Allies).

THE ARMY AIR FORCE TASK.

TO: a Destroy the industrial war making capacity of Germany.
b Restrict Axis air operations.
c Permit and support a final invasion of Germany.

ACTION NECESSARY TO ACCOMPLISH THE TASK.

No. Selected Targets	Results
50	Disrupt electric power.
47	Disrupt transportation.
27	Destroy 80% synthetic petroleum.
18	Destroy airplane assembly plants.
6	Destroy 90% aluminum.
6	Destroy magnesium.
154	Total targets to destroy and keep destroyed to accomplish the task.

FORCE REQUIRED TO ACCOMPLISH THE TASK

The exact number of airplanes required to assure the complete destruction of these 154 selected targets has been determined by a detailed study of bombing accuracy in wartime operations including pursuit and antiaircraft opposition. This approach and analysis has established the requirement that 6834 operating bombardment airplanes are required to accomplish the task during the six month period that weather conditions favor operations over Germany.

However, absence of necessary bases and time required to design and manufacture necessary number of 4000 mi. radius of action bombers combine to force use of double combat crews. These conditions are met by an Interim Expedient Force consisting of the following:

Based in United Kingdom: Units	Operating Airplanes	Monthly Replacement In Airplanes
10 Gps (B-25&26*)	850 Bomb	286 Bomb
20 Gps (B-17&24)	1360 Bomb	456 Bomb
12 Gps (B-29&32)	816 Bomb	273 Bomb
10 Gps Pursuit	Pur. 1300	Pur. 209
Based in Near East:		
12 Gps (B-29&32)	816 Bomb	273 Bomb
6 Gps Pursuit	Pur. 780	Pur. 126
TOTAL.....	3842 Bomb 2080 Pur.	1288 Bomb 335 Pur.

* These airplanes included because of availability only. Longer range, greater load carrying airplanes would be far more economical. These airplanes to be replaced by longer range airplanes at the earliest possible date.

AIR STAFF - WPD

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(Serial 707)

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A-WPD/1

TAB 3

ARMY AIR FORCE BOMBARDMENT OPERATIONS AGAINST GERMANY

1. THE ARMY AIR FORCE MISSION: — (Condensed extracts from ABC-1 and Rainbow 5)

Beginning on D-Day and with increasing power until the final phase —

TO WEAKEN GERMANY,
TO RESTRICT AXIS AIR OPERATIONS,
TO SUPPORT FINAL OFFENSIVE (assault or occupation).

2. THE OBJECTIVES:

a. The available information on the German military and civil establishments leads to the conclusion that several systems of objectives are vital to the effectiveness of the German Air Force and the civil and military strength of the German nation (Air Intelligence - Estimate of the Situation (Tab 2)). A study of the size of the Air Force necessary to destroy each of these systems of objectives leads to the conclusion that only certain of these objectives which are vital are also within the capabilities of an Army Air Force of the size that could be produced in the reasonably near future.

b. The systems of objectives, the destruction of which first will accomplish the mission and second are within the capabilities of an Air Force which we can develop, are:

Electric Power	To Weaken Germany
Inland Transportation	
The Petroleum Industry	
Bombing of Civil Population of Berlin	
German Airplane Assembly Plants	To Restrict Axis Air Operations.
Aluminum Plants	
Magnesium Plants	
The Objectives listed above	To Support Final Offensive
Military Targets in the Interior	
Battlefield Targets	

3. SIZE OF BOMBARDMENT COMPONENT OF AAF REQUIRED TO ACCOMPLISH THE MISSION: —

a. More data and further study are necessary to afford a better analysis than is now available of the vital systems of objectives. More data are required on the specific location and detailed description of the vital points within these systems of objectives which would provide most profitable targets for air attack.

b. Summary: — The total bombardment force set up to accomplish the mission comprises 98 Bombardment Groups. Consideration of the availability of bases (Tab 5 - Bombardment Bases for Operations against Germany) and the resultant requirements for radii of action breaks this number of 98 Groups into types as indicated below:

10 Groups, M.B. (Similar to B-25 or B-26, or improved models)
20 Groups, H.B. (" " B-17 or B-24, " " ")
24 Groups, " (" " B-29 or B-32, " " ")
44 Groups, " (4000 mile operational tactical radius of action)
98 Groups — Total

(Tab 3, Section II, Part III, Appendix II)

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4. INLAND WATERWAY TRANSPORTATION: --

a. The transportation system of Germany is indispensable to the functioning of her military organization and national structure. The disintegration and failure of this system can be brought about by the neutralization of the inland waterway system and by simultaneous attack upon certain selected points in the railway system. The inland waterways carry 25% of the total freight transported in Germany and the railways could not stand up under this additional load if the inland waterways were destroyed. It is estimated that the existing inland waterway establishment can be paralyzed by the destruction of 9 locks, 3 ship elevators and inland harbor facilities at Mannheim and Duisburg.

b. In 1943, a projected Rhine - Main - Danube Canal system may be completed. Additional data and further study may develop the necessity to destroy this Canal establishment also. If such proves to be the case, it may be necessary to double approximately, the bombardment force set up herein to destroy the known existing inland waterway establishments. There are set up in this force, sufficient bombardment airplanes to take out three ship elevators or three locks in this canal system now under construction and about which little detailed information is available.

c. Force Required for Destruction of Inland Waterways: -- 11 Groups of Bombardment (heavy or medium). (For detailed description of the targets, see Tab 2).

5. RAIL TRANSPORTATION: --

a. The rail net of Germany would be unable to absorb the full freight load if the inland waterway establishment were destroyed. It is estimated that the destruction of about 15 marshalling yards and about 15 other sensitive points within the rail net, in conjunction with the attacks on the inland waterways, will cause the disintegration and failure of the transportation system of Germany.

b. Force Required for Destruction of Rail Net: -- 19 Groups Bombardment (heavy or medium). (For detailed description of these targets, see Tab No. 2).

NOTE: Attention is invited to the fact that the destruction of these targets calls for a large bombardment force. It is not to be inferred that this force or any other force cannot be used for other purposes. During major air operations, some of the vital elements of the German Air Force and airplane manufacturing installations about which information is now very obscure will surely be uncovered. At that time, all or portions of this force can be diverted to attacks on the German Air Force.

6. THE PETROLEUM INDUSTRY: -- a. Twenty-seven (27) synthetic oil plants concentrated in 3 areas in western and central Germany account for nearly 50% of Germany's supply of crude petroleum. The destruction of these establishments will not only very greatly reduce the gasoline available for the operation of the German military land and air machine, but will interfere with the production and supply of: carbon gas black (tires, ink and paints), alcohols (antiseptics, lacquers, essential oils), chemical solvents, naphthas, kerosene, furnace oil, diesel oil, waxes, heavy oils (lubricating, emulsifying, transformer

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and flotation oils), asphalt, pitch, tar, sulphuric acid, synthetic plastics and synthetic rubber.

b. Force Required for Destruction of Petroleum Objectives: — 17 Groups of Bombardment (heavy or medium). (For detailed description of these targets, see Tab No. 2).

7. ELECTRIC POWER: -- a. Although Germany's rail net is not electrified, some 80% of Germany's total production of electric power is consumed in industry. The destruction of approximately 50 electric generating stations in Germany would eliminate some 40% of Germany's total generating capacity. The denial to Germany of 40% of her electric generating capacity at the same time that the German petroleum industry and inland transportation establishment is seriously interfered with, will in all probability cause the collapse of the German military and civil establishment.

b. Force Required for Destruction of Electric Power Objectives: — 32 Groups of Bombardment (heavy or medium). (For details as to these targets, see Tab 2).

8. BOMBING OF CIVIL POPULATION OF BERLIN: -- Immediately after some very apparent results of air attack on the material objectives listed above or immediately after some major set-back of the German ground forces, it may become highly profitable to deliver a large scale, all-out attack on the civil population of Berlin. In this event, any or all the bombardment forces may be diverted for this mission. No special bombardment force is set up for this purpose.

9. GERMAN AIR FORCE AND AIRPLANE MANUFACTURING ESTABLISHMENTS:

a. The German air establishment, military and civil, may include 3000 widely dispersed and carefully camouflaged manufacturing establishments. Similarly, the German Air Force is widely dispersed, well concealed and heavily defended. It is known, however, that there are 18 large airplane assembly plants, 6 large aluminum plants and 6 magnesium plants which are of great importance to the German airplane manufacturing establishment. Air units are set up to destroy these plants. As additional key establishments are located, it may be decided to divert other forces from their systems of objectives to the attack of aviation facilities or factories.

b. Force Required for Destruction of Known Airplane Manufacturing Establishments: -- 19 Groups of Bombardment (heavy or medium). (For details as to these targets, see Tab 2).

10. MILITARY TARGETS IN THE ZONE OF THE INTERIOR AND BATTLEFIELD TARGETS IN SUPPORT OF THE FINAL OBJECTIVE: -- When control of the sea has been obtained and an overwhelming air superiority has been achieved, the presence of large friendly ground forces and their offensive operations against Germany are expected. At that time, it is believed that a large portion of the bombardment force set up for operations against Germany will no longer be required for the specific missions indicated and will be properly diverted by the theater commander to operations directly related to the success of the ground forces. For this reason, no bombardment force is set up in this Tab for the specific purpose of supporting the final objective (except units in the Support Commands, see Tab 10).

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(Serial 707)

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TABULATION OF BOMBARDMENT UNIT FORCE REQUIRED

1. Total Bombardment Airplanes and Units Required.

Type (1)	Group	Combat Sqs.	OTU* Sqs.	Hq. Sqs.	Total Planes	Initial 25% Reserve(3)	Monthly Attrition Rate (2) a	Monthly Attrition Rate (2) b
M/B B-26 Type	10	40	10	10	850	212	(143)	286
M/B B-24 Type	20	80	20	20	1360	340	(228)	456
M/B B-32 Type	24	96	24	24	1632	408	(273)	546
M/B 4000 Mile Rad.	(44)	(176)	(44)	(44)	(2992)	(748)	(501)	--
Totals (Incl. 4000 mi. Acs.)	(98)	(392)	(98)	(98)	(6834)	(1708)	(1145)	
Totals Initial Op'ns (See Note 2b)	54	216	54	54	3842	960		1288

*Operational Training Units.

Notes: (1) Requirements in first three lines include those bombardment airplanes that can be based in British Isles and Suez area. Requirement on the fourth line is the difference between those required and those that can be based in British Isles and the Suez area. (See Tab 5 - Bombardment Bases for Operations against Germany for discussion).

(2) Current A.D. attrition rates (20% per month loss in airplanes by all units except operational training units where 3% prevails) are applied throughout.

a. Replacements required if the indicated numbers of 4000 mile radius of action airplanes are available (probably 1944 or later).

b. Replacements actually required until the indicated numbers of 4000 mile radius of action airplanes are available. All shorter radius of action airplanes in operation against Germany must be operated by double combat crews until that date. (See Tab 4 for discussion). Single combat crew operation may be resumed when the 4000 mile airplanes are available.

(3) Initial 25% Reserve on basis of total planes.

(TAB 3(a), SECTION II, PART III, APPENDIX II)

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2. Airplanes Required by Types of Missions. (Note 1)

Type of Objective (1)	No. of Targets	Groups	Planes in Hq & Combat Sqs.	Planes in OTU* Sqs.	Total Planes
Inland Waterways	17	11	627	143	770
Rail Transportation	30	19	1083	247	1330
Petroleum Industry	27	17	969	221	1190
Electric Power	50	32	1824	416	2240
German Air Force & Airplane Mfg. Estabs.	30	19	1083	247	1330
	154	98	5586 (2)	1274 (3)	6860 (4)

* Operational Training Units.

Notes: (1) The numbers of airplanes computed herein are based on the total requirement to accomplish the mission. The lack of adequate air bases and the difficulty of manufacturing airplanes of sufficient radius of action (4000 miles) forces the expediency of employing double combat crews on shorter radius of action airplanes. (See Note 2 b, Par 1 of this Tab).

(2) The number of planes considered for combat missions.

(3) These planes not considered as performing combat missions.

(4) Difference between this total and that appearing in paragraph 1 due to factors pertaining to airdromes and difference between number of planes in medium and heavy bombardment squadrons.

(TAB 3(a), SECTION II, PART III, APPENDIX II)

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J.B. No. 355
(Serial 707)

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TAB 3 (b)

BASIS FOR CALCULATION OF FORCE REQUIRED TO DESTROY TARGETS

1. BASIS:

The only sound method of forecasting the capabilities of a force in accomplishing a particular mission is to take past records and apply such additional factors as may be available. The application of the theory of probabilities and the Law of Errors in the determination of the bombardment force required to accomplish a given result is the best basis that can be applied.

Only a smattering of facts are available as the basis on which to answer the question, "How many bombardment airplanes should we employ in two or three years hence to penetrate the resistance which may be interposed against us at that time to reach and to find those objectives and to be practically sure that the necessary number of the proper sized bombs hit their targets and that the mission will be accomplished?" Among these facts are the following: The British bombing range standard of bombardiers' accuracy is known. As a result of 15 attacks on one target, it can be deduced that the probable British bombing range error is 2½ times greater in actual operations when confronter by anti-aircraft artillery, hostile pursuit, day and night conditions, favorable and unfavorable weather, some camouflage and some concealment. Precise data as to the American bombardiers' current bombing range errors are known. The computations which follow are, therefore, based on increasing the American bombing range probable error by 2½ times (as was the case with the British in the only instance on which data are available) when the American bombardier moves from the bombing range into actual combat operations.

2. THE CURRENT AMERICAN BOMBARDIERS' BOMBING RANGE PROBABLE ERRORS:

The probable errors considered as a basis for calculations are those obtained from June through December 1940, throughout the bombardment units. These probable errors are slightly larger than those of which must be met by student bombardiers before they are graduated as 3d Class Bombardiers. These probable errors are considerably greater than those obtained by the Air Forces in previous years. More emphasis on training will reduce them considerably. However, these errors are sound data on the current American bombardier's accuracy and they must be accepted as a basis for calculation.

3. PROCEDURE IN CALCULATING THE FORCE:

a. Assumptions: Bombing altitude - 20,000 feet.
Current American Errors (Range - Probable Error -- 220 feet.
(Direction -- Probable Error -- 275 feet.
Assumed Average Size of Target: 100 ft. x 100 ft.

b. Determination of Single Shot Probability:
50 ft / 220 ft. Rep = .1230 Probability of hitting in Range
50 ft / 275 ft. Dep = .0966 Probability of hitting in Direction
Single Shot Probability = .012

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c. 90% Probability of Hitting with One Bomb:

Note: Assumption - one hit of proper size bomb on target should effect its destruction. The majority of targets will be susceptible of destruction by bombs of the smaller sizes (1000#-500#). One hit of such size bomb indicates a high probability of other hits from remaining bombs released from plan simultaneously. Hence, for purpose of calculation, one bomb equals one airplane as a conservative basis for calculating force.

Single Shot Probability of .012 results in a requirement of 220 bombs (planes) to secure one hit.

Result: To secure one hit against target of selected size — 220 airplanes (bombers) are required.

d. Organization: -- One bombardment group consists of 5 squadrons, one for operational training and one headquarters squadron. Each squadron consists of 13 airplanes of which 9 are employed on a combat mission.

Airplanes in Group:

Group Headquarters	-	3	
Four Combat Sqs	-	52	- 36 used on combat missions
One Operational Sq	-	13	
TOTAL IN OP.	-	68	

36 planes considered used on one group mission.

e. 220 plane missions equals 6 group missions for one target per current (3d class) bombardier accuracy in peace time.

f. War time errors assumed to be 2.25 times those of peace time. The force required in war time is thus 2.25 squared or 5 times that for peace time bombing.

g. War Time Group Missions:

6 Group Missions in peace x 5 - 30 Group Missions required to secure destruction of one target in war. (Note: To get one hit, 30 Group Missions are required. With normal bomb loadings, 30 Group missions release 1080 2000 lb bombs, 2160 1100 lb bombs or 4320 600 lb. bombs.)

h. Period of time devoted to destruction of each of the several classes of targets selected:

As a general statement, weather which favors continuous bombardment operations (See Tab 15) will be found over Germany only during the six summer months. As a result all computations are based on surely smashing each target one time during a six month operating period and prohibiting repair by an occasional attack in much smaller force.

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J.B. No. 355
(Serial 707)

SECRET

A-WPD/1

4. INLAND WATERWAY TRANSPORTATION:

a. 14 vital points in existing canal system.
3 vital points in proposed Rhein-Main-Danube System.
17 vital points in inland waterway transportation system.

b. 17 targets to be hit during 6 month operating period.
17 targets x 30 group missions per target equals 510 group missions.

c. 510 group missions divided by 8 missions per group per month equals 64 Group Months.

d. 64 Group Months divided by 6 months (operating period) equals 11 Groups required for 6 months of operation.

e. 11 Groups x 70 planes per Group = 770 tactical operating airplanes.

11 Headquarters and Hq. Squadrons	=	55 planes
11 Operational Training Squadrons	=	143 planes
44 Combat Squadrons	=	572 planes
		770 planes

5. RAIL TRANSPORTATION:

a. 15 marshalling yards.
15 other sensitive points within the rail net.
30 vital points in the rail transportation system.

b. 30 targets to be hit during 6 months of operation.
30 targets x 30 Group missions per target = 900 Group missions.

c. 900 Group missions divided by 8 missions per Group per month = 113 Group months.

d. 113 Group months divided by 6 months (operating period) = 19 Groups required for 6 months.

e. 19 Groups x 70 airplanes per Group = 1330 operating airplanes

19 Headquarters & Hq. Squadrons	=	95 airplanes
19 Operational Training Squadrons	=	247 "
76 Combat Squadrons	=	988 "
		1330 "

6. THE PETROLEUM INDUSTRY:

a. 27 synthetic oil refineries comprise the vital points in the petroleum industry.

b. 27 targets x 30 Group missions per target = 810 Group missions.

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c. 810 Group missions divided by 8 missions per Group per month = 101 Group months.

d. 101 Group months divided by 6 months (operating period) = 17 Groups required for 6 months.

e. 17 Groups x 70 airplanes per Group = 1190 airplanes.

17 Headquarters and Hq. Squadrons	=	85 Aps.
17 Operational Training Squadrons	=	221 Aps.
68 Combat Squadrons	=	884 Aps.
		1190 Aps.

7. ELECTRIC POWER:

a. 50 electric generating stations represent the vital points in the electric power establishment.

b. 50 targets x 30 Group missions per target = 1500 Group Missions.

c. 1500 Group Missions divided by 8 missions per Group per month = 188 Group months.

d. 188 Group months divided by 6 months (operating period) = 32 Groups required for 6 months.

e. 32 Groups x 70 airplanes = 2240 Airplanes.

32 Headquarters and Hq. Squadrons	=	160 Aps.
32 Operational Training Squadrons	=	416 Aps.
128 Combat Squadrons	=	1664 Aps.
		2240 Aps.

8. GERMAN AIR FORCE AND AIRPLANE MANUFACTURING ESTABLISHMENT:

a. 18 assembly plants.
6 aluminum factories.
6 magnesium factories.
30 vital points in German airplane manufacturing establishment.

b. 30 targets x 30 Group missions per target = 900 Group Missions.

c. 900 Group missions divided by 8 missions per Group per month = 113 Group months.

d. 113 Group months divided by 6 months (operating period) = 19 Groups required for 6 months.

e. 19 Groups x 70 airplanes per Group = 1330 operating airplanes.

19 Headquarters and Hq. Squadrons	=	95 Aps.
19 Operational Training Squadrons	=	247 Aps.
76 Combat Squadrons	=	988 Aps.
		1330 Aps.

(Tab 3 (b), Section II, Part III, Appendix II)

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(Serial 707)

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TAB 4

ESCORT FIGHTERS

1. Principal Function of Escort Fighters.--As the name implies, the function of this class of aviation is the escort in close support of other classes of aviation. The escort fighter hence affords protection against the efforts of hostile pursuit and fighter aircraft to destroy the escorted formation or to prevent the accomplishment of its mission.

2. Necessity For This Class of Aviation. Consideration of Bombardment Aviation.--a. The effectiveness of an Air Force in contributing to the defeat of an enemy is measured by the efficiency of the bombardment component in destroying vital enemy objectives. Day bombing, in which the target may be most readily seen, will result in the highest bombing accuracy.

b. The German Air Force began daylight attacks against England. The efficiency of the British Air Defense system and the technical superiority of the British pursuit airplanes, well armored and mounting eight machine guns, overwhelmed the German bombardment airplanes which carried few guns of weak calibre and which were indifferently armed. Thus the German bombers met the British pursuit on unequal terms. Support by German single seater fighters failed to protect the bombers. The former had to abandon the German bombardment formation when combat took place.

c. It is clear that the technical superiority of the British fighter airplane over the German bomber was the principle reason for the heavy losses of German airplanes which accounted for practical abandonment of Nazi daylight attacks. The United States is endeavoring to overcome in its bombardment airplanes that technical deficiency present in the German bombers, by increased gun power in larger calibre machine guns and in cannon; in power operated turrets; in adequate armor protection for the combat crew and vital parts of the airplane.

d. It has not yet been demonstrated that the technical improvements to the bombardment airplane are or can be sufficient to overcome the pursuit airplane, permitting day operations in the face of strong pursuit opposition. It is hoped that the defensive measures in technical improvements will insure this. It is anticipated that the interceptor airplane and the effectiveness of its fire will be further improved and it is not impossible that the present relative superiority of the interceptor over the bomber may be maintained.

e. The importance of day attacks is recognized in seeing hits against vital targets. It is unwise to neglect development of escort fighters designed to enable bombardment formations to fight through to the objective.

(TAB 4, SECTION II, PART III, APPENDIX II).

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3. Characteristics of the Escort Fighter.--This airplane must have the radius of action of the bombardment planes it supports. Slightly higher speed is essential to permit it to move from one position to another with respect to the bombardment formation. It must carry the maximum number possible of machine guns and cannon. Of the greatest importance, each member of the crew must be adequately protected by armor. The Escort Fighter must be designed to fulfill one role; defense against hostile pursuit.

4. Tactics of the Escort Fighter.--The escort fighter would initially take positions on the flanks and rear of the bombardment formation. When combat was formed, these planes would be maneuvered to positions where the maximum hostile pursuit attack was developing. In substance, the escort fighters would be so disposed that hostile pursuit could not attack the bombardment formation with impunity, without first passing through the fire of the aerial fighters, or without first disposing of them.

5. Strength of the Escort Fighter Component.--The number of escort fighters would depend primarily upon the technical efficiency of the airplane in armament and armor. It is believed that the maximum number of these airplanes would be on the proportion of an escort squadron per bombardment group. These fighters will be required only when the enemy had developed an efficient air warning system. And the required number of fighters would, in the final calculations, be much less than on the ratio of an escort squadron to a bombardment group. The decision would depend upon the technical development and test.

6. Recommendation.

a. That the possible need for the escort fighter, designed solely for defense purposes, be recognized.

b. That the Army Air Forces establish military characteristics and specifications for this type of airplane immediately.

c. That upon approval of b. above, thirteen (13) escort fighters be built by which tests of the efficiency of this weapon may be determined through the organization of an Escort Fighter Squadron.

d. That if the need for this weapon is determined our industry must be further expanded to construct these airplanes or reduction in the production of other types be made so that adequate escort fighters can be constructed.

(TAB 4, SECTION II, PART III, APPENDIX II).

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J.B. No. 355
(Serial 707)

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TAB 5

BOMBARDMENT BASES

For Operations against Germany

1. Discussion.

a. The air force that can be employed against a hostile nation is that which can be placed within the radius of action of enemy objective from available bases.

b. The bombardment units required for operating against Germany have been estimated, together with the pursuit aircraft required for defense of the bases.

c. The radius of action of the bombardment airplanes and available bases are then considered. 6860 bombardment airplanes is the estimated requirement for operations against Germany. It develops that but 169 bases are available, which will accommodate 3842 bombers and 1690 pursuit for operations against Germany. An additional 117 airdromes to accommodate 3018 bombers are required.

2. See Tab 5(a)for detailed discussion of the problem. See Tab 5(b)depicting the advantage of the 4000 miles radius of action bomber from the standpoint of bases in exercise of American air power through the world.

(Tab 5, Section II, Part III, Appendix II)

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J.B. No. 355
(Serial 707)

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TAB 5 (a)

AIRDROMES AVAILABLE IN UNITED KINGDOM AND MIDDLE EAST

1. Data on British Expansion Program in England:

Basis - Cablegram August 1, 1941. AG 381 (8-1-40)
MC No. 74 from London to The Adjutant General.

a. Ultimate RAF Expansion Program.

No. of Sqs.	Type	Planes Per Sq.	Estimated Tot. Initial Equip.
40	Fighters (long-range)	16	640
104	Fighters (short-range)	16	1,664
279	Bombers	16	4,464
6	Torpedo Bombers	20	120
13	General Reconnaissance Boats	9	117
16	General Reconnaissance Land	20	320
458			7,325

b. Total Airdromes - 465 plus 23 in Eire.

Fighter Command	- 144	
Coastal Command	- 44	
Army Cooperative Command	- 19	
Bomber Command	- 170	
Total First Line Airdromes		377
Operational Training Airdromes		88
Eire (suitable for fighters and bombers)		5
(suitable for light bombers and Army cooperative aviation)		4
(potential sites)		14
Total available and potential (Notes 1 and 2)		488

Notes: (1) Projected airdromes can be increased very little.
(2) A irdromes considered to be large enough to accommodate two squadrons.

(Tab 5 (a), Section II, Part III, Appendix II)

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2. Airdromes required for British Expansion Program and Remainder Estimated Available for American Units.

British Requirements	Estimated Available Airdromes (2)	Req'r'd. for British	Available for U. S.
144 Fighter Squadrons	144	72	72
279 Bomber Squadrons	170	139	31
Operational Training Airdromes	88	78 (1)	10
Airdromes projected in Eire	23	4 (4)	19 (3)
Coastal Command	44	44	-
Army Cooperative Command	19	19	-
	488	356	132

NOTES: (1) Based on British transferring 10 operational units to Canada.
(2) Army Cooperative and Coastal Command airdromes not considered for American use due to lack of more definite information.
(3) 19 out of 23 potential airdromes considered suitable for American units.
(4) Suitable only for light bombers or army cooperative aviation.

3. U. S. air units that can be based in British Isles predicated upon above data.

a. Ratio of 1 fighter airplane to 2 bombardment airplanes (Basis - British ratio of 2304 fighter airplanes to 4664 bomber airplanes).

b. 132 airdromes can accommodate 264 squadrons.

Type (2)	Gps	Combat Sqs	Combat Aps.(1)	OTU* Sqs	OTU* Aps.	Total Aps.	Airdromes	Total Aps. Per Gp.
M/B B-25) 26 Types)	10	40	690	10	160	850	25	85
H/B B-17) 24 Types)	20	80	1100	20	260	1360	50	68
H/B B-29) 32 Types)	12	48	660	12	156	816	30	68
TOTALS ...	42	168	2450	42	576	3026	105	
Pursuit...	10	40	1050	10	250	1300	25	130
GRAND TOT.	52	208	3500	52	826	4326	130	

* Operational Training Units

NOTES: (1) Gp Hq planes based with a combat squadron and included in combat airplane totals.
(2) Models selected on division of the British Isles in three general base areas:
Southern Area for B-25 and 26 planes
Central Area for B-17 and 24 planes
Northern Area for B-29 and 32 planes.

(Tab 5 (a), Section II, Part III, Appendix II)

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4. U. S. Air Units that can be based in the Suez Area. (Basis: Report of Intelligence Division, OCAC, 8/7/41, subject: "British Controlled Airfields in Africa and the Near East within 2000 miles of Berlin and believed suitable for bomber operations." Copy filed with AAF files.)

a. The number of existing airdromes is extremely small, when the size of the area is considered. Unquestionably, a large number can be constructed from the standpoint of available area. However, other considerations will introduce limiting factors, among which are:

(1) Availability of construction materials and difficulty in shipping them to this area from the United States or elsewhere.

(2) Difficulties in the supply and maintenance of large numbers of squadrons so far removed from base of supply.

Action has been taken to secure additional data upon which a refinement of the estimate as to airdromes in the Near East may be made.

b. Location of Bases

	Airdromes
Anglo-Egyptian Sudan	1
Cyprus	2
Egypt	7
Iran	3
Iraq	12
Palestine	3
Syria	4
Transjordan	7
Total Airdromes	39

It is assumed:
(1) That British will make these airdromes available.
(2) The ratio of pursuit to bombardment airplanes of 1 to 2 maintained in this area.
(3) Improvements where essential to be made.

c. (39 airdromes will accommodate 78 squadrons.)

Type	Gps	Combat Sqs	Combat Aps.	OTU Sqs	OTU Aps	Total Aps	Air-dromes	Tot. Aps. Per Group
H/B B-29 & B-32 type	12	48	660	12	156	816	30	68
Pursuit	6	24	630	6	150	780	9*	130
	18	72	1290	18	306	1596	39	

* It will be assumed that these 9 airdromes can be expanded to accommodate 24 rather than 18 squadrons or that an additional 3 airdromes to accommodate 6 squadrons can be constructed.

(Tab 5 (a), Section II, Part III, Appendix II)

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d. Summary of U. S. planes that can be based in British Isles from standpoint of operating bases:

	Total Bombers	Combat Bombers	OTU Bombers	Tot. Pur..	Comb. Pur.	OTU Pur.	Air-dromes.
British Isles	3026	2450	576	1300	1050	250	130
Suez Area	816	660	156	780	630	150	45
	3842	3110	732	2080	1680	400	175

5. Informative Summary of British and American Aircraft.

		Bombers	Pursuit
British)	British	4464	2304
Isles)	American	3026	1300
Suez)	British	?	?
Area)	American	816	780
		8306	4384

6. American Requirements in Bombers predicated upon operation areas.

Estimated Requirement ..... 6860 (not including 25% reserve or monthly attrition)

Bombers for which airdromes are available:

Medium Bombers based in G.B.	850
B-17 type bombers " " "	1360
B-29 " " " " "	816
B-29 " " " Suez Area	816
Total U. S. Bombers	3842

Bombers estimated as required for which airdromes are apparently not available--- 44 groups 3018

7. Problem in securing bases for 3018 Bombardment Airplanes for which no bases appear to be available.

a. Requirements in airdromes. -- The above paragraph indicates that bases for 3018 bombers are not available. With 13 planes per squadron, 2 squadrons per airdrome, an additional 117 two-squadron airdrome, within a radius of 2000 miles of the vital German industrial areas, are required.

8. The Problem. -- Either these airdromes must be constructed or airplanes of a greater radius of action than the B-29 or B-32 must be constructed in order to increase the availability of airdromes.

a. First Solution. -- Construct 117 airdromes in the British Isles, the Suez Area, Iceland, or Russia. The number of air bases projected for the British Isles cannot be increased by any appreciable amount. From the standpoint of area, it is possible to construct a large number of bases in the Suez Area. Practical difficulties, such as the supply of bases, available water, availability of material for their construction will probably limit the number of bases that can be built in that area. Further investigation is being made. Use of Russian bases will depend upon future situations that cannot be predicted.

b. Second Solution. -- Use double combat crews for

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airplanes that can be based in British Isles and Near East, to perform 16 instead of 8 missions per month. Estimate in airplane requirements based on a bombardment force of 6860 airplanes of which the 5544 operating airplanes perform 8 missions per month for six months (less approximately 25% of the latter which are held out for maintenance). Of the force of 3842 airplanes that can be provided airdromes, 3110 are operating airplanes. On the assumption that the 3110 operating airplanes (less approximately 25% of the latter which will be undergoing maintenance on the ground) employ the double operating rate, the result in theory will provide for approximately 9% more missions than would be possible with the 8 mission rate per month with the 5544 bombers.

(1) The advantages are:

(a) Maximum use would be made of the equipment.

(b) The initial production problem in aircraft would be lessened. However, the attrition rate would be increased from 20% to 40% and a higher production program would be required to maintain 3842, than to maintain 6820 aircraft.

(2) The disadvantages are:

(a) The weather may not permit 16 operations per month.

(b) War time maintenance would be doubled in using 3110 airplanes to do the missions of 5544. Hostile bombings of airdromes, the necessity of night maintenance under field conditions, supply difficulties with aircraft so far from the source of supply will tend to cut down the 16 missions per month. Increased maintenance personnel would be needed. The units would be operating on a narrow margin of safety in endeavoring to maintain the airplanes for double missions.

(c) With a force of 5544 bombers performing eight missions per month, a reserve of force is present. At a critical period, where the breakdown of a particular enemy industry was indicated, the whole force performing for short period missions at a heavier rate than on the basis of eight missions per month, could double the bombing effect that would be possible with 3110 airplanes. Thus 6860 airplanes with a total of 5544 operating airplanes provide, in part, a reserve for a major effect at a critical time. This reserve is lost by depending on a force of 3482 airplanes of which 3110 are operating airplanes which must perform sixteen missions per month — a maximum effect from that number of aircraft.

c. Third Solution. — To have a war plan study made in cooperation with the British Royal Air Force to determine if the 4464 British Bombers and the 3842 American Bombers — a total of 8306, may be sufficient to accomplish the defeat of Germany from the standpoint of combined air force operation. (Estimates in Tab 2 - Air Intelligence — Estimate of the Situation, are that Germany will have 7245 bombers in air fleets with 100% in depot reserve as of July 1, 1943.)

d. Fourth Solution. — Reduce the number of operational training squadrons to 1/3 of those set up, converting them to combat squadrons. This would increase operating squadrons

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to 38 and increase the operating aircraft to 494, and reduce airdrome requirements by 19. Obviously the gain would not compensate for the reduction in training personnel for combat which would result from this policy.

e. Fifth Solution. — (1) Eliminate the Medium Bomber (B-26 type) and the Heavy Bomber (B-17 type) substituting therefor the Heavy Bomber (B-29 type). Estimated performance data on usable ranges for purpose of comparison only are:

Model	Range	Bomb Load
B-26	1150 miles	2000 lbs
B-17	1135 "	4800 "
B-29	2410 "	16000 "

From the standpoint of maximum bomb load alone, the B-29 airplane is equivalent to:

8 B-26 planes
3 1/3 B-17 planes

Replacing the B-26 and B-17 types with the B-29 type on the basis of the former two airplanes set up for the operations against Germany, the following academic result would obtain:

850 B-26 type x 8 = 6800 on a gain of 6050 planes
1360 B-17 type x 3 1/3 = 3533 on a gain of 2173 planes
Academic increase by substituting
B-29 plane 8223 planes

(2) From the standpoint of hits, however, the academic increase would be reduced considerably. In war it is best to calculate on a single release of all bombs, rather than release of each bomb singly on separate approaches. Hence the probability of hitting is not increased in proportion to the increased number of bombs carried.

(3) It is clear that substitution of the B-29 type, for the B-17 and B-26 types, would reduce considerably the shortage due to unavailability of airdromes. Time limitations in preparing this tab have not permitted the thorough study that will be continued on this solution.

f. Sixth Solution. — (1) To build aircraft with a 4000 mile operating radius of action to the total of 3740, which could operate against Germany from:

Newfoundland
Northeastern U. S. and Canada
Africa - Ivory Coast
Greenland
India

(2) The development of the bombardment airplane with a 4000 mile radius of action is of great importance. With such a bomber, the United States could, from bases under its control, exercise air power over all important areas. (See map Tab 5 (b)). The development of such an airplane has been initiated. A project to manufacture such an airplane

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in tactical quantities (3740 required on the basis of this study) should be initiated immediately.

f. Seventh Solution. -- The seizure of areas suitable for construction of air base, from Dakar north on the West Coast of Africa or in Norway by combined air, naval and ground operations.

9. Conclusion:

a. The final solution of the problem will necessarily involve a combination of the several contemplated above.

b. That solution most acceptable is the procurement of the bombardment airplanes having an operating radius of action of 4000 miles and a maximum range of 10,000 miles. With a force of airplanes of this type, the United States would be in a position to operate against Germany from airdromes far removed from the threat of German attack. A wide selection of operating bases throughout the world would be possible. Furthermore, no matter what the final outcome of the war in Europe, the Army Air Forces, in cooperation with the Navy would be able to cover with aerial operations the principal oceans of the world and could operate against bases and installations on the lands adjacent thereto - a situation highly favorable to our National interests. The procurement problem will delay the adoption of this solution.

c. The immediate expediency which must be adopted, is the use of double combat crews as discussed under the second solution, recognizing its many disadvantages.

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in tactical quantities (3740 required on the basis of this study) should be initiated immediately.

f. Seventh Solution. -- The seizure of areas suitable for construction of air base, from Dakar north on the West Coast of Africa or in Norway by combined air, naval and ground operations.

9. Conclusion:

a. The final solution of the problem will necessarily involve a combination of the several contemplated above.

b. That solution most acceptable is the procurement of the bombardment airplanes having an operating radius of action of 4000 miles and a maximum range of 10,000 miles. With a force of airplanes of this type, the United States would be in a position to operate against Germany from airdromes far removed from the threat of German attack. A wide selection of operating bases throughout the world would be possible. Furthermore, no matter what the final outcome of the war in Europe, the Army Air Forces, in cooperation with the Navy would be able to cover with aerial operations the principal oceans of the world and could operate against bases and installations on the lands adjacent thereto - a situation highly favorable to our National interests. The procurement problem will delay the adoption of this solution.

c. The immediate expediency which must be adopted, is the use of double combat crews as discussed under the second solution, recognizing its many disadvantages.

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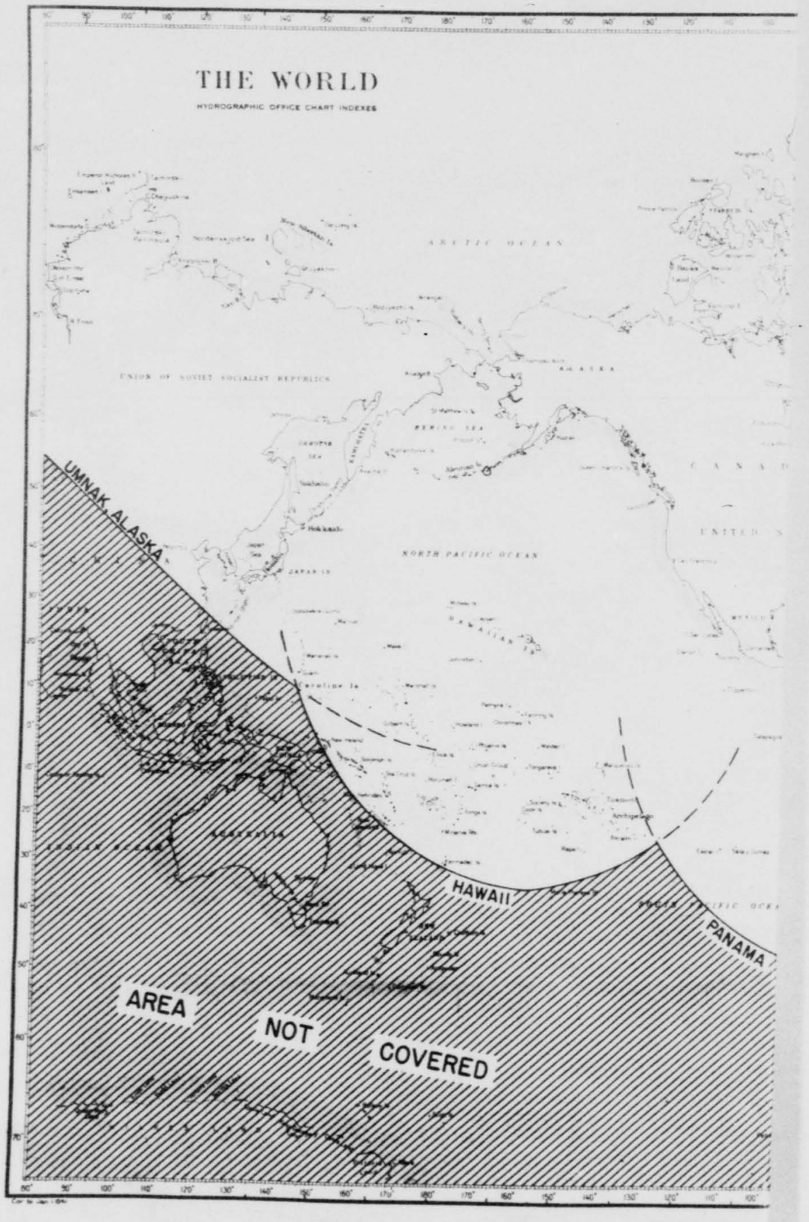

4000 Mile Radius
Umnak, Alaska - Hawaii - Pana

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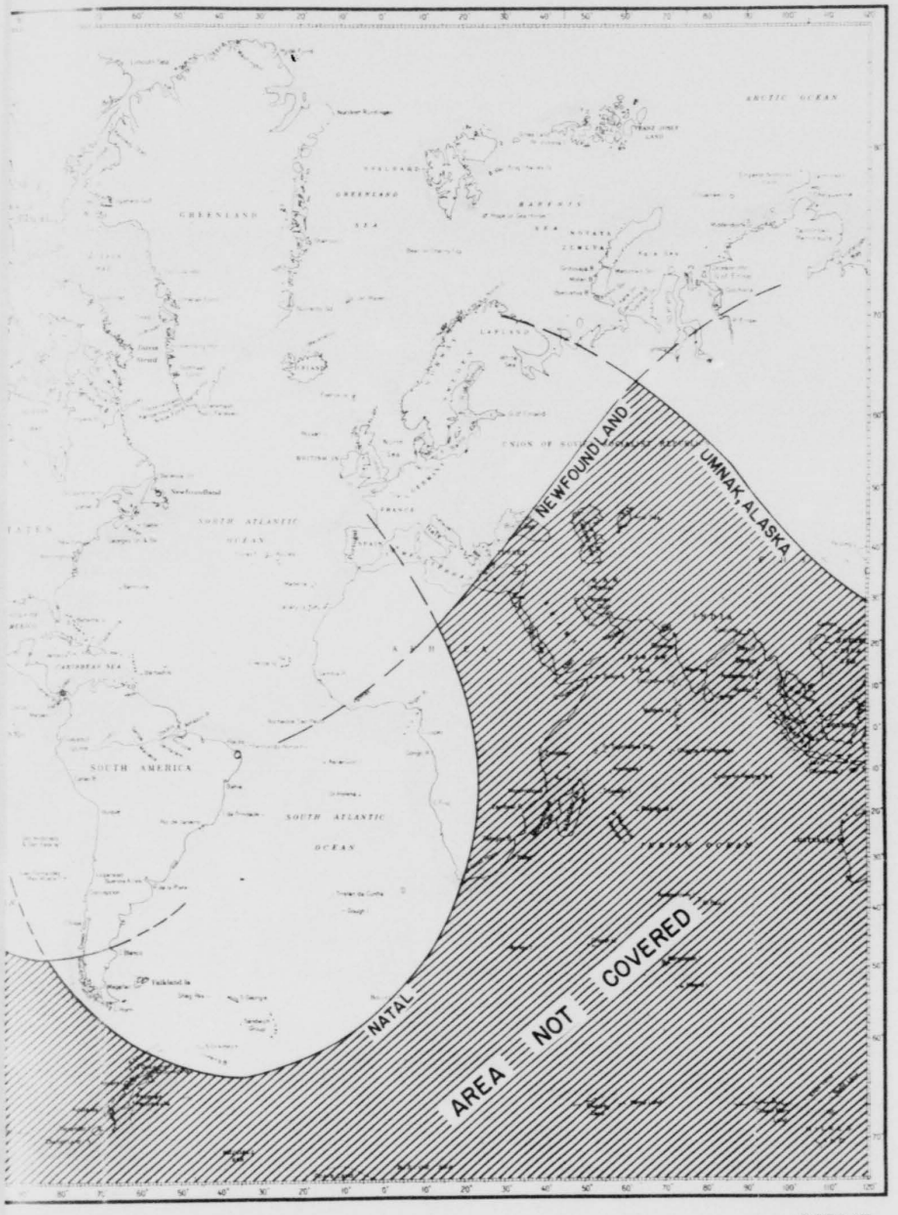

INDEX AX

INDEX AX

From 5 bases at
- Newfoundland - Natal, Brazil

PART III, APPENDIX II)

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J.B. No. 355
(Serial 707)

A-WPD/1

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TAB 6

ARMY AIRCRAFT TO BE USED FOR CONTROL OF THE SEAS
(Operations in Support of and in Lieu of The Fleet).

1. Assumptions.

A force for this purpose has been set up as such. An assumption is made that the aircraft included under Hemisphere Defense and for the Strategic Defensive of Asia will be adequate to the support of sea forces or for operations in lieu thereof, from the air bases at which such forces are located.

2. Use of Air Forces on this mission prior to offensive in Europe.

The building up of the air force units required for an offensive in Europe will progress gradually until completion of the program and the entire force is operating against German objectives. During this program, units will be organized and trained, gradually being moved to European or Near-Eastern bases. Prior to the offensive, such of the first units, when formed and ready for action, will be available initially for the mission of operating against hostile seacraft, in conjunction with naval forces or in lieu thereof. It is not an unreasonable assumption that such operations will succeed in this initial mission, and that special forces will not be required.

3. Use of the Air Forces created for Hemisphere Defense.

The fulfillment of the mission of Hemisphere Defense includes the destruction of hostile seacraft within the operating radius of the air bases, together with reconnaissance essential thereto. The forces established for Hemisphere Defense have been held to a minimum consistent with an offensive in Europe requiring the major effort. This force, however, is estimated to be adequate.

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J.B. No. 355
(Serial 707)

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TAB 7

30 BASIC AVIATION AND UNITS FOR HEMISPHERE DEFENSE

I. PROBLEM.

To provide for Hemisphere Defense by locating, at strategic points, the minimum number of Bombardment Groups capable of performing that mission during the conduct of our strategic offensive in the European theatre.

MISSION:

a. To protect our vital economic and military objectives against carrier, or flying deck based air attacks.

b. To defend the Pacific Triangle, Alaska and approaches to the Panama Canal.

c. To acquire data and information concerning requirements, technical and tactical, to enable the United States to institute an all-out Hemisphere Defense in the event of a forced retirement from the European theatre.

ASSUMPTIONS:

23 Groups, with a total of 1955 heavy bombardment airplanes, which figure includes a 25% reserve, with a monthly replacement requirement at 3% per month of 46 airplanes.

II. DISTRIBUTION OF BOMBARDMENT POWER REQUIRED.

OPERATING BASE	GROUPS	COMBAT (4 SQ)	OTU (4 SQ)	RTU (4 SQ)	TOTAL PLANES	25% RES.	T.O. & EFL. (3%)
Continental U.S.	5	20	5	5	340	85	10
N.E. Area	(1)	(4)	(1)	(1)	(68)	(17)	(2)
Norfolk Area	(1)	(4)	(1)	(1)	(68)	(17)	(2)
So. Calif.	(1)	(4)	(1)	(1)	(68)	(17)	(2)
San Fran. Bay	(1)	(4)	(1)	(1)	(68)	(17)	(2)
Seattle, Wash. Area	(1)	(4)	(1)	(1)	(68)	(17)	(2)
Greenland	1	4	1	1	68	17	2
Newfoundland	1	4	1	1	68	17	2
Puerto Rico	1	4	1	1	68	17	2
British Guiana:							
Georgetown	1	4	1	1	68	17	2
Brazil	3	12	3	3	204	51	6
Belem	(1)	(4)	(1)	(1)	(68)	(17)	(2)
Natal	(1)	(4)	(1)	(1)	(68)	(17)	(2)
Rio de Janeiro	(1)	(4)	(1)	(1)	(68)	(17)	(2)
Chile, Antofagasta	1	4	1	1	68	17	2
Peru, Lima	1	4	1	1	68	17	2
Mexico, Acapulco	1	4	1	1	68	17	2
Panama	2	8	2	2	136	34	4
Hawaii	3	12	3	3	204	51	6
Alaska	2	8	2	2	136	34	4
Iceland	1	4	1	1	68	17	2
TOTAL	23	92	23	23	1564	391	46

(TAB 7, SECTION II, PART III, AND INDIX II).

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J.B. No. 355
(Serial 777)

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S E C R E T

RECAPITULATION

Total Groups. 23

Airplanes in Groups 1564
Airplanes in reserve (25%). . . 391
Total Airplane Requirement. 1955

Monthly Replacement - 3%.. 46 Airplanes.

III. BASIS FOR DISPOSITION OF THE FORCE.

ASSUMPTIONS:

a. That all aerial reconnaissance, over water, excepting that essential to develop the tactical situation, is to be performed by the Naval Air Service. (Attention is invited to the inability of seaplanes to operate during winter months from northern latitudes due to existence of ice in landing and take-off areas.)

b. That, while the United States is participating in a major offensive in Europe, minimum forces are required for Hemisphere defense.

c. That the size of the bombardment force mentioned herein as suitable for Hemisphere defense during this strategical phase has no relation to the number of bases that must be developed to make possible our maximum hemisphere defense plans if the offensive in Europe cannot be carried through.

DISPOSITION:

a. Continental United States.-(1) Northeastern Sector - three mutually supporting Groups are provided at Norfolk, New England and Newfoundland.

(2) Pacific Coast - three mutually supporting Groups provided for the Pacific Coast sector.

b. Caribbean Area.-Mutually supporting Groups at Norfolk, Puerto Rico and Georgetown with Reserve support in Panama are provided.

c. South America.-Mutually supporting Groups cover all but the southern third. Extension to provide this coverage can be accomplished.

d. Panama Canal.-Coverage is provided by two Groups in the Canal Zone itself as well as supporting Groups at Acapulco and Lima on the Pacific side and the strong Caribbean Force previously mentioned. Coverage to the West could be doubled by the establishment of a base in the Galapagos Islands. This is strongly recommended.

(TAB 7, SECTION II, PART III, APPENDIX II).

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J.B. No. 355
(Serial 707)

A-PD/1

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g. Hawaii.-A relatively strong force is considered necessary here as this constituted the key point in the defense of the Pacific Triangle. Three Groups are provided, and, although shown in Hawaii may be utilized from advance bases on Midway, Wake, or Jarvis Islands. Reinforcement by at least one Group from the West Coast is practicable without serious weakening of that sector.

f. Alaska.-Two Groups are believed sufficient since the air defenses of this area can be speedily reinforced from the United States proper.

e. Iceland.-The placement of one Group in Iceland furnishes a force capable of rendering strong support to the Navy in its mission of maintaining freedom of the sea lanes of the North Atlantic.

h. The preponderance of strength is provided towards the west in view of the offensive effort in the east.

i. The provision of six Groups in South America is believed to be required in order to give support to our commitments regarding Hemisphere defense and to maintain our good relations and prestige with the South American Republics.

(TAB 7, SECTION II, PART III, APPENDIX II).

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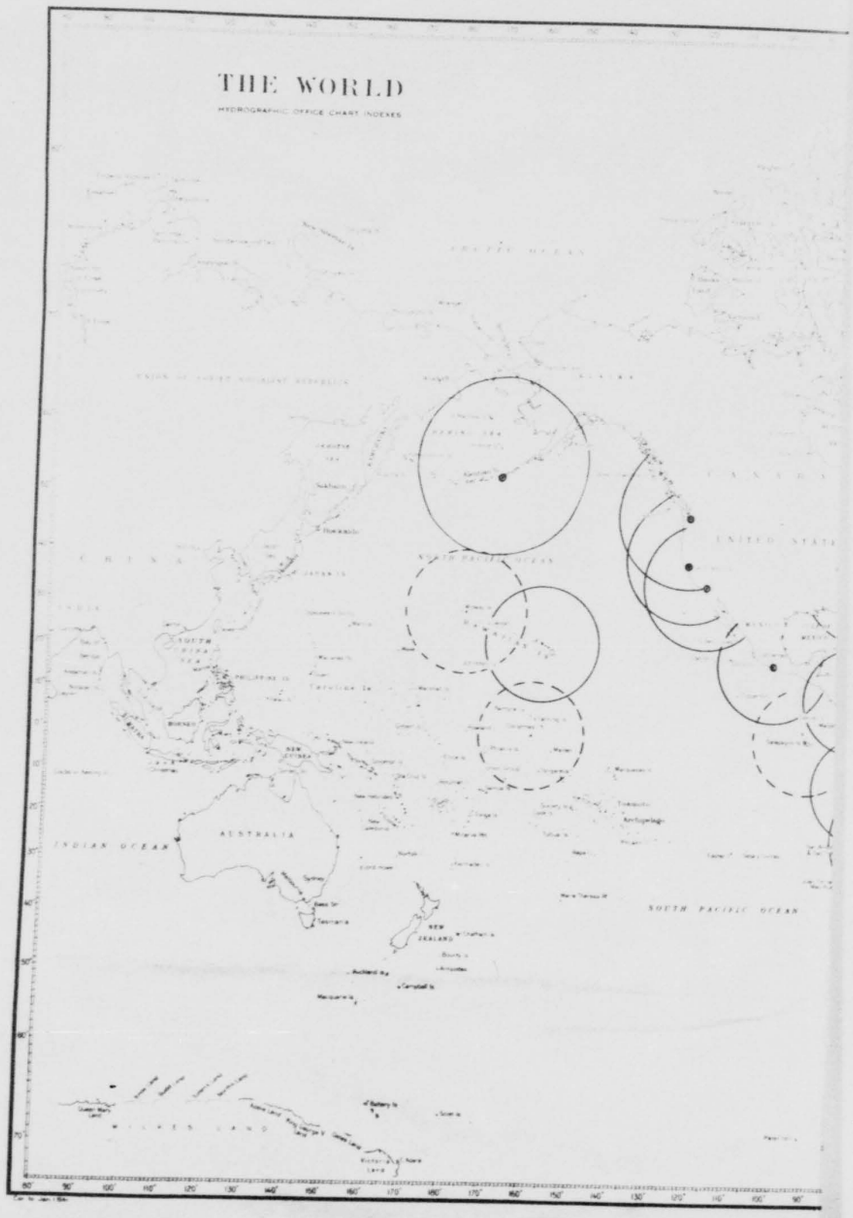

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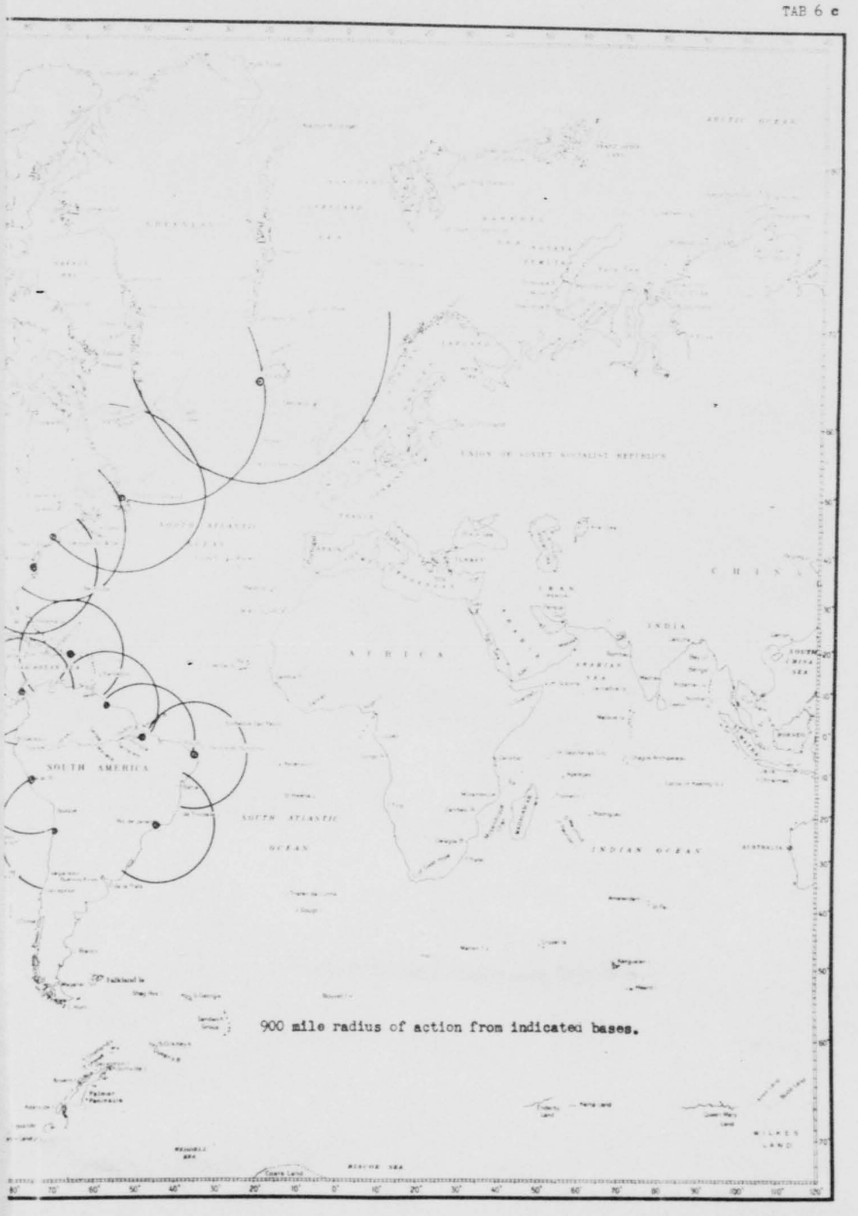
AND OPERATING RADII B-17 AND B-24

TAB 6 c



INDEX AX

PART III, APPENDIX II)

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J.B. No. 355
(Serial 707)

SECRET

AWPD/1 TAB 8

BOMBARDMENT AVIATION REQUIRED FOR STRATEGIC DEFENSIVE IN ASIA

1. Problem. a. The strategic concept of operations required to defeat our potential enemies directs a strategic defensive in the Far East. It also directs that we "Defend the Philippines."

b. The integrity of these islands is too important to our position in the Far East and our prestige in the world to permit it to pass under Japanese control.

c. A moderately strong Air Force, with its bases protected by ground forces would constitute a major obstacle to Japanese freedom of movement in the Far East.

d. Such a force would dominate the northern approaches to the China Sea and would act as a powerful deterrent to Japanese penetration in the Netherlands East Indies and would divert enemy strength away from the Malay barrier.

e. These factors, together with a noticeable tendency towards a strengthening of our national policy in the Far East, make imperative that plans be considered at once for a substantial increase in our forces in the Far East.

2. A study of the Far Eastern theatre indicates that:

a. Four groups of B-17 or B-24 type airplanes, in the Philippines, would seriously threaten the northeastern approaches to the China Sea.

b. The same groups would provide a strong defense to any overseas operations directed against the Philippines.

c. B-29 or B-32 type airplanes operating from Alaska, with one refueling area in Russia, could conduct bombing operations against sensitive and vital points in Japan.

d. Similar operations could be conducted by the same type of airplanes based in the Philippines.

3. The potentialities created by basing a moderately strong Air Force in the Far East are so great that it is considered essential to give serious thought to:

a. Strengthening the garrison of the Philippines to provide protection for present, or near future, air bases.

b. Movement, as soon as possible, of four heavy bombardment groups to the Philippines.

c. Conduct conversations with Russia regarding the use of a refueling area in Siberia at such time as B-29 or B-32 airplanes may become available.

4. Bombardment Strength Recommended.

Operating Base	Type	Number Required	Monthly Replacement	Number Sqs	Number of Gps	Operating Range and Bomb Load
Philippines	(B-17: (B-24:	272	54	20	4	(1500 mi. (2000 lbs.
Alaska or Philippines	:B-29: :B-32:	136	27	10	2	(4000 mi. (2500 lbs.

(TAB 8, SECTION II, PART III, APPENDIX II)

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J. P. No. 355
(Serial 707)

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TABLE I

[illegible]

Type	Total Grps.	Total Sqds*	Combat Sqds.	O.T.U. Sqds.	HQ Sqds.	Op. Acft.	Res. Acft.	Total Acft.	Repl. in Acft.**
Offensive against Germany									
I	21*	84	63	21	21	2205	551		331
II	-	21	21	-	-	525	131		80
TOTALS	21	105	84	21	21	2730	682	3412	411
* 5 Groups initially stationed in Western Hemisphere.									
Hemisphere Defense									
I	31	124	93	31	31	3255	814		98
II	-	31	31	-	-	775	194		23
TOTALS	31	155	124	31	31	4030	1008	5038	121
Strategic Defense in Asia									
I	2	8	6	2	2	210	53		33
II	-	2	2	-	-	50	12		6
TOTALS	2	10	8	2	2	260	65	325	41
Total Pursuits by Types									
I	54	216	162	54	54	5670	1417		462
II		54	54	-	-	1350	337		111
GRAND TOTAL PURSUITS									
	54	270	216	54	54	7020	1755	8775	576

* Operating Squadrons only, i.e., Headquarters Squadrons and Control Squadrons excluded.
** Replacements needed for estimated attrition, monthly rate.

NOTES:

1. Each Interceptor Group is assumed to have 130 airplanes and seven Squadrons, as follows:

	I	II
3 Combat Squadrons, I (day Interceptor)	75-I	
1 Combat Squadron, II (night Interceptor)		15-II
1 O.T.U. Squadron, I	25-I	7-II
1 Hq. Squadron, I	5-I	
1 Control Squadron, I (Communications)		
Total airplanes	105-I	25-II

(TAB 9, SECTION II, PART III, APPENDIX II).

- 1 -

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In the event that sufficient 3-place night interceptor airplanes cannot be made available for all I Groups, then an I squadron of P-61 airplanes will be substituted for the VII Combat Squadron and III O.T.U. Night.

2. AWS (Signal Corps) Units adequate for controlling Interception Missions, Day and Night, are assumed for all I units.

3. One control squadron for each pursuit group is assumed, to provide ground radio and wire communications for both administrative and tactical purposes. Telephone and teletype wire lines over long distances must be provided by other agencies.

4. Attrition is assumed at the following rates:

20% per month for all combat squadrons in active combat areas;
3% per month for all other units;
None for airplanes in depot reserve.

The O.T.U. and Headquarters Squadrons are not considered "combat squadrons". All groups listed in Hemisphere Defense are considered to be not in combat areas -- hence 3% per month. All other groups are in combat areas --hence their attrition rate is 20% for combat squadrons, or 20% for 73 I per Pursuit Group (I), and 20% for 100-P per Pursuit Group (P).

5. It is assumed that 10 Groups (I) will be needed for defense of bases in Great Britain and Ireland, and 6 more defense of bases in the Near East. Also, that additional units will be needed to support bombardment missions over Germany, and to support offensive sweeps over nearby hostile areas.

6. Airdromes for but 10 Pursuit Groups in British Isles and 6 in the Near East are assumed to be available. Attainment of Air Supremacy over Germany will require more than purely defensive action by Pursuit.

7. No additional Pursuit is listed for Support of Ground Forces. Five of the 6 Groups in Hemisphere Defense reserve should train with the Five Support Commands. When an Army takes the field, it will be given Pursuit (I) protection of one or more Groups depending on the situation, the size of the area to be defended and density of pursuit defense necessary. (See Note 6.)

(TAB 9, SECTION II, PART III, APPENDIX II).

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J.P. No. 355
(Serial 707)

A-PD/1

Tab 9 (a)

PURSUIT AVIATION REQUIRED FOR OFFENSIVE AIR OPERATIONS

1. NUMBER OF GROUPS REQUIRED:

a. Defense of American bases in British Isles — 10 Groups

b. Defense of American bases in Near East — 6 Groups

c. Defense of American bases in other areas — 0 Groups

TOTAL — 16 Groups

d. Airdromes required, at 2 operating squadrons each, for 16 Groups, or 30 Squadrons = 40 Operating airdromes
5 OTU
45 Total Airports

2. DISCUSSION OF TOTAL AIR PURSUIT:

a. More than half of all our pursuit aviation is required for employment in the strategic defensive. (See Tab 9 (b)). The reasons for this are:

(1) The principal mission of pursuit is defensive; i.e., protection of bases and vital areas. In the European theatre, bases to be defended are compressed into small areas compared with the great dispersion of bases and other vital areas in the Western Hemisphere and in the Far East.

(2) Limitations are imposed by the relatively small number of existing and potential airdromes available for our pursuit operations in the "offensive" theatre. (Only sufficient for 10 Groups in England, 6 Groups in the Suez Area.)

(3) It is necessary to maintain a strong force engaged in Hemisphere Defense, based on the assumption that no pursuit units established in the Eastern Hemisphere can be returned to the Western Hemisphere in event of a withdrawal from Europe, Africa or Asia. Units sent abroad cannot be depended on when counting the total available for Hemisphere Defense.

b. Compared to the German Air Force as of July 1, 1943, German interceptor and fighter aviation of all types in the Air Fleets is estimated at approximately 6000 airplanes, with an equal number in depot reserve. (The 100% depot reserve is certainly less than four times as valuable compared to a 25% reserve, because of obsolescence and maintenance problems.) Add other Axis air force components plus the advantages in available airdromes which the Germans will have, and it must be concluded that a decisive numerical superiority over Germany is not to be sought in pursuit aviation. It could only be attained at the expense of our bomber aviation which is, in the Air Offensive, our real striking force.

(TAB 9 (a), SECTION II, PART III, APPENDIX II).

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J.B. No. 355
(Serial 707)

A-3/1

c. As air supremacy will not be determined by superiority in number of fighters, it must be attained otherwise. For defense of American bases, the British R.A.F. has indicated the solution - a highly integrated Aircraft Warning and Interceptor Control System directing squadrons of superior interceptor pursuit airplanes manned by well trained, determined airmen.

d. To attain the air supremacy over hostile territory necessary to support an invasion, superior fighting ability will count still more heavily, there being no elaborate integrated Interceptor Control System. (See paragraphs 5 and 6 below for the additional pursuit units required.)

3. [illegible] (See par. 1 a) [illegible]:

a. Total bomber and pursuit force which can be operated from bases available in Great Britain was estimated in Paragraph 3, Tab 5 (a), and the proportion of bombers to pursuit was taken to be 2 - 1, as a reasonable proportion. Allowing an average of 2 squadrons per available and potential airdrome, the pursuit allowance of bases is then enough for only 10 Groups.

b. Assuming American responsibility to defend its own bases, and guessing at the territory involved, then all 10 Groups may be needed in defense of our bases. This is an arbitrary guess, and must be, until the distribution and location of American bases is known and a joint plan for Air Defense is worked out with the British Fighter Command.

c. Assuming further the possible concentration of the bulk of the German Air Force against Britain, and allowing for the enemy capability of greatly increasing the number of airdromes in northern France and the Low Countries, then a strong interceptor pursuit defense of our bomber and naval bases is essential. Without British cooperation, 10 Groups are obviously inadequate. It must be assumed, however, that the R.A.F. will continue to defend its homeland, and our responsibility will be limited to the defense of our own bases.

4. [illegible] (See Par 1 b) [illegible] AS FOLLOWS:

a. Hostile air bases are either remote, or on a relatively narrow front.

b. The number, spread and location of American bases to be defended are not definitely known.

c. The capacity of the terrain to provide airdromes is unlimited, but water supply and other material considerations limit the force of bombers and pursuit which can base in this area. The estimate of bomber force to be based in Near East, and potential air fields available limits the number of airdromes available for pursuit to 9. Assuming that more airdromes can be built, or allowing more squadrons per airdrome,

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it is estimated 6 groups can be based and supplied in the Near East. No smaller number would insure adequate defense of the American air bases in that theatre. (The factors involved in this estimate are too intangible at this time to support more than a reasonable guess as to the actual amount of pursuit needed.)

5. DEFENSE OF OTHER AREAS. (See Par. 1 c)

a. Except for the British Isles and the Near East, only Russia can provide bases near enough to Germany to support the air offensive. Neutral countries and axis-controlled territory are assumed to be not available. Because Russian territory west of the Ural Mountains appears likely to come under German control very soon, no Air Bases have been planned for that area. Therefore, no pursuit aviation is needed for protection of bases other than those so far discussed.

b. Should additional base areas be set up, then pursuit protection must be provided from units in strategic reserve, or the estimate of total pursuit force required must be revised.

6. STRATEGIC RESERVE.

a. An additional force, to that prescribed in paragraph 1, of 6 groups is required for what may be called a strategic reserve. It is needed for the following purposes:

(1) To reinforce defense of bases in emergency.

(2) To attain local air supremacy in any area chosen, within range of its bases.

(3) To support the independent air operations of our bombardment aviation.

(4) To support ground forces for combined air and ground offensives.

(5) To provide pursuit aviation for other task forces.

b. Requirement for Strategic Reserve. The estimate of force required was based on the following assumptions:

(1) Number of bases available is limited. In this respect the estimate given in Tab 5 (a) allows no additional airdromes in Great Britain and Iceland. A strategic reserve is essential, or the mission of pursuit will not be achieved. Therefore, more airdromes must be found, or squadrons will have to double up again on existing bases, or other measures must be undertaken to secure new bases. Initially, the Strategic Reserve must be located in the Western Hemisphere.

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(2) The bomber force cannot be materially reduced to provide more bases for pursuit units.

(3) A successful ground offensive must have air support and local air supremacy.

(4) Initial air supremacy must be attained locally to enable a ground force to establish itself in hostile territory.

(5) The number of groups in strategic reserve needed for achieving the air supremacy which is a prerequisite to establishing ground forces in hostile territory will be sufficient to maintain air supremacy in support of further operations of those ground forces in the new theater. No units will be organically assigned to armies or held exclusively for army support.

(6) To insure efficient practical coordination of pursuit and AT units with armies in the field, a minimum of one group and one mobile A S regiment, per army must take part in all Army field exercises in peace or war. These training missions must be provided for from strategic reserves at home or abroad. Whenever possible, the group (and A S regiment) that trained with an army will accompany it in the field.

7. PURSUIT TYPES AND QUANTITY.

a. A special type of interceptor pursuit airplane is needed for night operations. It must have performance equal or superior to hostile bombers. It works best alone or in pairs, has a 3-man crew, is bi-motored and has a greater endurance and useful load than the day interceptor. Because of its size and load, it is less maneuverable than the day interceptor. It has both fixed and turret guns. Because it is not employed en masse, for a given area defense, the number needed is less than needed for day fighting. It is assumed after careful study, that adequate air protection demands the best defense possible both by day and by night. The proper proportion of day to night pursuit is as shown in Note 1 to Tab 9.

b. For day interceptors more than one type is needed. To engage hostile fighters at extreme altitude, a very high-flying type is needed. The large engine and supercharger required may make this airplane inferior in maneuverability and speed at low altitude. Hence a combination of types similar to the Spitfire-Hurricane team has advantages. The DI (day interceptor) airplanes in one group should be all of one type. However, every effort must be made to achieve practical fighting superiority on which depends, more than on numbers, aerial supremacy.

c. To accompany bombers, a large, heavily gunned long-range escort fighter is needed. In lieu of such a fighter,

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J.B. No. 355
(Serial 707)

A- PD/1 SECRET

additional interceptors for short-range support of bombardment should be provided, if the escort fighters cannot be built. As no prototype even exists, it would be wrong to count on this new type, but the tactical requirement for such an airplane exists and a program for development of the type should not be neglected.

(TAB 9 (a), SECTION II, PART III, APPENDIX II).

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(Serial 707)

A-WPD/1

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TAB 9 (b)

PURSUIT REQUIREMENTS FOR HEMISPHERE DEFENSE

1. SUMMARY. The following summarizes the pursuit required to protect vital establishments and to garrison the bases needed for hemisphere defenses:

	Groups (Each 130 Aps.)
Continental United States	12
Iceland	1
Newfoundland, Greenland and Labrador	2
Bermuda	½
Bahamas and Jamaica	½
Puerto Rico	1
Antigua, Saint Lucia, Trinidad, British Guiana	1½
Other Latin-American and U.S. Bases	6
Panama	2
Hawaii	3
Alaska	1½
TOTAL	31 Groups, 4030 Aps.
Add 25% for depot reserve	1007 Aps.
Force required by 7-1-43	5037 Aps.

Additional Pursuit units assigned to offensive against Germany but initially employed in Hemisphere Defense:

Air Base Defense, Brazil	3 Groups 390 Aps.
Metropolitan Defense, Rio de Janeiro	1 Group 130 Aps.
Air Base Defense, Chile and Peru	1 Group 130 Aps.
	5 Groups 650 Aps.

These airplanes are listed under offensive against Germany.

Monthly production after 7-1-43, to maintain U.S. Force, at 3% per month (.03 x 4030) 121 Aps.

Or 1450 airplanes per annum.

2. BASIS FOR ESTIMATE. For figuring the requirements summarized in paragraph 1 above, calculations were based on the following assumptions.

a. That the Air Force is conducting offensive operations against Germany and the Probability of hostile attacks is limited.

b. That if we are forced to hemisphere defense exclusive of European and Asiatic adventures, no pursuit which was employed in the Eastern Hemisphere will be available for Western Hemisphere defense. However, the productive capacity set up to maintain the offensive force will provide enough additional pursuit airplanes for effective hemisphere defense.

(TAB 9 (b), SECTION II, PART III, APPENDIX II).

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c. That our pursuit is individually equal to its task of defeating hostile aircraft engaged. This includes airplane performance, armor and armament, training, etc.

d. That adequate Aircraft Warning Service is available and under Interceptor Command, trained and equipped to permit ground-controlled interceptions - (NOTE: Requirements for AWS are large, and are discussed separately.)

e. That replacements in personnel as well as in equipment and supplies will be adequate to maintain the HDF (Hemisphere Defense Force).

3. COMPOSITION OF UNITS. The composition of one Pursuit Group (I) is assumed to be as follows:

Squadrons	Airplanes		Total
1 Hq. Sq.	5 (I)		5
1 Control Sq.	----		---
3 Operating Sqs.	75 (I)		75
1 Operating Sq.		17 (NI)	17
1 O.T.U. Sq.	25 (I)	8 (NI)	33
7			130

(I) is for Interceptor, single-seater.
(NI) is for Night-Interceptor, three seater.
(NOTE: No fighter pursuit is included, as no basis for its employment in Hemisphere Defense is available. No fighter airplane exists now in our Air Force.)

4. DISPOSITIONS. The following is a discussion of items listed in paragraph 1:

a. Continental United States.

12 groups disposed as follows:

1 AF Area 6 frontier regions (Buffalo to Boston to Norfolk). 5
2 AF Area 2 frontier regions (Seattle and Portland). 2
3 AF Area 5 frontier regions (Washington to Miami). 3
4 AF Area 4 frontier regions (San Francisco and Los Angeles). 2

b. Iceland.

1 group (No discussion necessary) 1

c. Newfoundland, Greenland and Labrador.

(1) To defend American bases, air and naval, Botwood - Gander Lake, Tor Bay, and Argentia. 1

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(2) For defense of staging fields and intermediate subbases from Stephenville, Newfoundland, to Greenland and for defense of Greenland bases and Cryolite mine. 1

d. Bermuda.

Terrain limitations and nature of point defense indicate less than a full group. . . . . .

e. Bahamas and Jamaica.

To defend American patrol base in the Bahamas, air and naval bases in Jamaica, and possible temporary bases in Cuba, ½ group. . . . . ½

f. Puerto Rico.

Containing a highly important naval base, as well as air bases, required a minimum of one group. . . . 1

g., h., i., j. Antigua, Saint Lucia, Trinidad and British Guiana.

These constitute one integrated defense, as no pursuit is needed at Antigua unless bombers move in. Saint Lucia similarly needs pursuit only when Air or Naval forces are concentrated there. It is believed that the importance of Trinidad as keystone of the arch requires at least ½ group to be based there, with approximately a whole group available for dispersion, averaging one squadron each, to Antigua, St. Lucia and Georgetown. All or part of the reserve group could move quickly to reinforce any of the three subbases, as the situation demands. Hence, 2 groups are provided. 2

k. Other United States and Latin-American needs.

In this category should be included Canada.

(1) In the event that Canada fails to defend, with pursuit (I) the western termini of her transcontinental railroads, and the Nova Scotia bases, American units should be prepared to take over, or reinforce those regions as the situation may require. Unless some reserve force is available for such purposes, a gap in hemisphere defense may occur.

(2) Also, to reinforce any weak point in our continental frontier regions, a mobile reserve is necessary.

(3) To provide units for possible task forces to South America, to protect bases in Brazil, etc., a mobile reserve is needed.

(TAB 9 (b), SECTION II, PART III, APPENDIX II).

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(4) To provide mobile groups for air support forces in training with Armies in the Strategic Reserve, 5 groups are needed.

(5) The disposition of the 6 groups available "for other purposes" is recommended as follows:

2 each in 1 AF and 3 AF Areas, and
1 each in 2 AF and 4 AF Areas,

TOTAL 6

l. Brazil.

To defend the air bases in the important northeast salient of Brazil, three groups are provided. An additional group is set up to provide a local metropolitan defense of Rio de Janeiro. Failure to provide pursuit defense of this important Brazilian city would seriously impair relations between the United States and Brazil, in the event that Rio was subjected to air attack - or even seriously threatened.

These four groups are earmarked for use in the offensive in Europe if and when we seek to establish a local air superiority for the employment of our ground forces in the European theatre. Presumably the air threat to Brazil will be small at that time. 4

m. Chile and Peru.

To defend air bases. 1 Group 1
This group is also earmarked for the offensive against Germany.

n. Panama.

The importance of this base and of the Panama Canal indicates a minimum of two groups, stationed one near each coast 2

o. Hawaii.

The importance of this citadel and naval base, and of naval forces which may be concentrated there, plus the difficulty of reinforcing the garrison, indicates a garrison of 3 groups. A part of this force may be required to garrison Midway. 3

p. Alaska.

To carry our the Army mission of defending Naval Bases, requirements for defense of Unalaska, Anchorage, Kodiak, Sitka and Fairbanks call for a widespread scattering of local pursuit units. Also; some force may be needed to defend any advanced air base established nearer Bering Straits to intercept raids from Siberia should the latter suddenly come under

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Axis control. For the many small tasks involved, and because of the difficulty of reinforcing these defenses, and because local operating conditions are such that any reinforcements not experienced in them are of doubtful value, a garrison of at least 1 group is indicated. 1

5. NIGHT-INTERCEPTOR SQUADRONS. For a total of 31 groups, 775 night fighter aircraft are required. These airplanes are not employed in mass as are day-interceptors, so only 18 airplanes per squadron are recommended. They depend entirely on ground control for effective night operations. Day pursuit can reinforce night interceptors on clear, moonlight nights, and also when pursuit-searchlight cooperation is applicable, but in general, night operations must depend on specially equipped night-interceptors.

(TAB 9 (b), SECTION II, PART III, APPENDIX II).

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J.B. No. 355
(Serial 707)

A-WPD/1

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TAB 9 (c)

PURSUIT AIRCRAFT REQUIREMENTS FOR STRATEGIC PLAN FOR THE FAR EAST

1. Summary of Requirements.

It is estimated that two groups will be required.

2. No bases are contemplated outside of the Philippine Islands. Disposition of the two groups required is as follows:

a. For the defense of Manila, naval forces and vital establishments in the vicinity . . . . 1 group

b. For defense of advanced bombardment air bases in Northern Luzon . . . . . 1 group

3. Should task forces be needed for operations in other areas in the Far East then the total requirements for pursuit aviation must be increased in the amount needed. It is not considered feasible to reduce in any way the size of pursuit forces allotted for Hemisphere Defense or to support an air offensive against Germany. As any further increase in the total pursuit requirements would necessarily be at the expense of other military effort, it is considered that the two groups allotted for defense of Philippine base are all that are justified in the Far East.

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J.D. No. 355
(Serial 707)

A- PD/1

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TAB 9 (d)

PURSUIT REQUIREMENTS FOR SUPPORT OF GROUND FORCES

1. DISCUSSION:

a. Peace time training.

For effective training in joint air-ground operations involving an aircraft warning service and air support operations, an appropriate pursuit force should be provided. To meet this need, five of the pursuit groups provided from reserves set up in the four (4) Air Forces should be made available and designated to train with the five air support commands in all joint air-ground operations.

b. War time employment.

For war operations, pursuit requirements for specific theaters will be determined by a specific estimate of the force required to provide effective support to the operations of the ground arms. One or more of the pursuit groups trained to operate with an Air Support Command should habitually form the nucleus of any pursuit force assigned to a ground theater.

c. Pursuit forces available.

(1) Six (6) groups are set up in reserves of Air Forces which can be made available to the support of ground arms for hemisphere defense.

(2) Five (5) groups are set up in general reserve for the British Isles which can be employed in support of ground forces in Western Europe. (Initially disposed in Brazil, Chile, and Peru.)

(3) Additional pursuit support in any ground theater may be assigned from active air defense units whenever the air and ground situation justifies such a transfer in employment.

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J.B. No. 355
(Serial 707)

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A-WPD/1

TAB 10

AIR SUPPORT AVIATION

REQUIRED FOR SUPPORT OF GROUND FORCES

1. DISCUSSION:

a. The following estimate of airplane requirements is based on the estimated strength and composition of the ground forces considered necessary to accomplish national objectives. Assumption is made that preponderant air superiority has been attained prior to the operations of these aviation units in any specific theater of operations. In arriving at estimated requirements, it has been recognized that all available combat aviation is able to, and in appropriate situations should support the theater operations of the ground arms.

b. It is recognized that air superiority within a theater may be highly variable and, against an undefeated enemy, never absolute. The need for pursuit aviation forces within the theater will be present, therefore, in varying strength, until the theater objective has been accomplished. In addition, there exists a tactical need for peace time training in joint air-ground operations, which is provided for. Detailed consideration of pursuit needs in supporting operations is treated in Tab 9 -- Pursuit Requirements.

c. Replacement rates are computed on the assumption that 40% of operating aircraft suffer a 20% monthly attrition rate with the remaining 60% computed at 3%.

2. Estimated requirements are tabulated below.

a. Bombardment aircraft, Light (A-20 Type).

(1) Initial Force:

Operating Airplanes		-	757
Depot Reserve		-	189
	Total	-	946
Squadrons	"	-	65
Groups	"	-	13

(2) Monthly replacement rate - 74

(3) Initial Disposition:

Air Support Commands	-	10 Groups
Iceland	-	1 Squadron
Brazil	-	1 Group
Puerto Rico	-	1 Squadron
Trinidad	-	1 "
Panama	-	1 "
Colombia-Ecuador-Peru	-	1 "
Alaska	-	2 "
Hawaii	-	1 "
Philippines	-	2 "

(Tab 10, Section II, Part III, Appendix II)

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b. Bombardment (dive bomber type)
(1) Initial Force:

Operating Airplanes	–	1004
Depot Reserve	–	251
Total	–	1255
Squadrons "	–	65
Groups "	–	13

(2) Monthly replacement rate – 98

(3) Initial Disposition:

Air Support Commands	–	10 Groups
Iceland	–	1 Squadron
Brazil	–	1 Group
Puerto Rico	–	1 Squadron
Trinidad	–	1 "
Panama	–	1 "
Colombia-Ecuador-Peru	–	1 "
Alaska	–	2 "
Hawaii	–	1 "
Philippines	–	2 "

c. Observation aircraft:
(1) Initial Strength:

Operating Airplanes	–	1521
Depot Reserve	–	380
Total	–	1901
Squadrons "	–	108

(2) Monthly replacement rate – 149

(3) Initial Disposition:

Armies	–	5 Squadrons
Corps	–	54 "
Armored Divisions	–	39
Iceland	–	1 Squadron
Brazil	–	3 "
Puerto Rico	–	1 "
Panama	–	1 "
Colombia-Ecuador-Peru	–	1 "
Alaska	–	1 "
Hawaii	–	1 "
Philippines	–	1 "

(Note: Squadrons for armored divisions to have 16 planes; all others to have 13.)

d. Photographic (mapping).
(1) Initial Strength:

Operating Airplanes	–	114
Depot Reserve	–	29
Total	–	143
Squadrons "	–	10
Groups "	–	2

(Tab 10, Section II, Part III, Appendix II)

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(2) Monthly replacement rate - 23

(3) Initial Disposition - GHQ - for use in theater of operations.

e. Transport - Air Infantry.
(1) Initial Strength:

Operating Airplanes	-	1216
Depot Reserve	-	304
Total	-	1520
Squadrons "	-	95
Groups "	-	19

(2) Monthly replacement rate - 75

(3) Initial Disposition:

Brazil - 4 groups	-	256 Airplanes
Caribbean Defense Command - 1 group	-	64 "
Alaska) 1 group 2 sq.	-	32 "
Hawaii) 1 group 2 sq.	-	32 "
Continental U.S. 8 groups	-	512 "
Strategic Reserves 5 groups	-	320 "
Total	-	1216 "

f. Gliders - Air Infantry:
(1) Initial Strength:

Operating Gliders	-	2400
Depot Reserve	-	600
Total	-	3000

(2) Monthly replacement rate - 153

(3) Initial Disposition:
To be determined by terrain analysis of specific areas.

Note: Gliders should relieve the transport load requirements in areas and tactical situations favorable to their use.

g. Supporting Pursuit Aircraft.
(1) Initial Strength:

Operating Airplanes	-	650
Depot Reserve	-	162
Total	-	812

(2) Monthly Replacement rate - 64

(3) Initial Disposition:
One Group to be available for operations with each air support command.
Note: This pursuit requirement is included in estimates established in Tab 9 - Pursuit Requirements.

(Tab 10, Section II, Part III, Appendix II)

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J.B. No. 355
(Serial 707)
A-WPD/1

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TAB 11

TRANSPORT AVIATION
REQUIRED TO MAINTAIN AERIAL LINES OF COMMUNICATION

1. This tab is designed to set forth the number of air transports required to effect the movement of critical essential aircraft and engine spares and supplies within the United States, between the United States and distant air bases or theaters and within theaters. The derived requirements are based in part on the rendering of a routine service and in part on the daily air movement of a fixed proportion of the total tonnage required to support an average operating group.

2. It must be accepted as inevitable that the production of certain essential aircraft and engine spares will be so limited as to necessitate holding to the minimum the quantities in the supply distribution system. The establishment of centralized stockages at the expense of local stockages to accomplish this, will, however, result in a material increase in the number of airplanes in the combat units that are out of service awaiting repair unless some method of ultra-rapid transportation is utilized to move critical items from the central stock point to the point of use. Air transportation has been found the most rapid and flexible method of effecting such movement and any war plan must provide such transportation if the number of combat unit airplanes held out of service for repair is to be held to the minimum.

3. Air transportation of air supplies may be considered under two broad headings:

i. Long Range (trans-oceanic, as to a European, African or Asiatic theater).

ii. Medium Range (Intra-theater and to bases near the zone of the interior.

a. Long range air transportation of supplies must be considered as purely an emergency expedient. Insofar as practicable, the supplies so transported should be limited to light-weight, small-bulk articles. For this type of trans-oceanic air transport service, the transports should have range and weight carrying characteristics at least comparable to those of the B-24. B-29 or B-32 characteristics would be preferable.

b. It is estimated that to provide a routine daily service of sufficient capacity to at least meet requirements initially and to insure a sufficient operating reserve to meet major emergencies, the following quantities of long-range high-capacity transports are required:

(1) U. S. - United Kingdom, 24 airplanes, 1½ squadrons

(2) U. S. - Brazil - Africa 24 airplanes, 1½ squadrons

(Tab 11, Section II, Part III, Appendix II)

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(3) U. S. - Oceana	24 airplanes,	1½ squadrons
(4) U. S. - Alaska	16 airplanes,	1 squadron
(5) Zone of Interior operating Reserve	40 airplanes,	2½ squadrons
Total	128 airplanes	8 Squadrons, 2 Groups.
25% Replacement	32	
Total	160 airplanes	

4. Medium range air transportation of supplies includes intra-depot and depot-to-air base movement. As with long range transportation, it should be utilized for the distribution of only those supplies which are not available in sufficient quantities to permit adequate local stockages. Air transportation is not considered justified in theaters of such limited geographical extent that surface forms of transportation provide approximately the same overall speed of distribution.

a. In arriving at the overall transport requirements for intra-theater and zone of interior service, it is thought best to first establish the service capacity of the basic transport unit - the squadron, equipped with 16 one-ton capacity transports. A serviceability factor of 3/4, a loading of 75 per cent capacity and an operational rate of 1½ trips every 2 days are arbitrarily assumed. It is further arbitrarily assumed that the average of all operating airplanes requires 4000 lbs. of all types of supplies per month, other than ammunition, bombs, fuel and oil and that not in excess of 20% of this material will have to be moved by air. On the foregoing basis, one squadron can move by air in one month 405,000 lbs.

(1) If one average airplane requires 800 lbs. of air transported material, one 16-airplane air transport squadron can furnish routine support to 500 "average" airplanes. This is considered the equivalent of six groups. It is realized that the material requirements for a heavy bombardment airplane may be considerably in excess of those for a pursuit airplane, but it is thought that the difference in airplane strength and operational rates and other influencing factors will generally tend to equalize requirements as between different types of groups.

(2) The basic plan contemplates a total force equal to 232 groups. 62 will be stationed in the British Isles where airdrome considerations practically prohibit the assignment of any material transport force, regardless of

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the need therefore. Hence only two transport squadrons are included for the British Isles. It is estimated that the equivalent of 18 groups will be located in areas wherein internal air transportation of supplies is not a vital requirement because of their limited geographical extent. No transport units are set up initially for such areas.

(3) The derived ratio is applied to the remaining 152 groups and indicates a requirement for 26 transport squadrons.

(4) Within the Continental United States, it is arbitrarily estimated that three transport squadrons are required to serve each of the three training centers; that three squadrons are required for maintenance command inter-depot service and an additional four squadrons are required for an Army Air Force operational reserve.

(5) The intermediate type air transports and transport units necessary to support the planned combat units and training activities and to provide a small operating reserve thus total:

704 airplanes - 44 squadrons - 11 groups.
25% replacement: 176
Total medium transports 880

5. Summary - Maintenance Command Air Transports (including 25% Reserve)

4-engine long range transports	160
2-engine medium range transports	880
Grand total Maintenance Command	1040

6. Monthly Replacement Requirements.

On the basis of an attrition rate of 3% per month, the following monthly transport replacements are required:

4-engine transports 4

2-engine transports 22

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J.B. No. 355
(Serial 707)
A-WPD/1

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TAB 12

PILOT TRAINING REQUIREMENTS
(Flying Schools and Training Airplanes)

I. "INTERIM EXPEDIENT" AIR FORCE.

1. Primary Training starts May 15, 1942 and requires a yearly pilot graduation rate of 85,236.

2. By initially operating at 50% of the desired technician strength the Primary School will be in full operation by July 15, 1942. The first full capacity class will graduate March 1, 1943.

The pilots available by March 1, 1943, based upon current plans will be:

	31,320
	1,320 - peace attrition
	30,000 - by March 1, 1943

New pilots to graduate to include July 1, 1943, will be 28,412, or a total at that date of 58,412.

The total requirements for pilots in tactical units is:

	61,623
Pilots for flying schools	21,567
Overhead	2,000
	85,190 - Required by July 1, 1943
	58,412 - Available by July 1, 1943
	26,778 - Shortage by July 1, 1943

3. With monthly pilot production of 7,103 (the 85,236 rate), it will take four months to meet this shortage. Therefore, we can fully equip the contemplated program with pilots under these assumptions November 1, 1943.

4. In order to establish the 85,236 pilot graduation rate, we will need 56.8 type schools. To meet the dates indicated above we will need:

Primary Trainers required by March 15, 1942	8,520	
On hand	4,325	
	4,195	short, which should be on hand Feb. 15, 1942.
Basic Trainers required by June 1, 1942	8,804	
On hand July 1, 1942	3,525	
	5,279	short, which should be on hand May 1, 1942.

(Tab 12, Section II, Part III, Appendix II)

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Two-engine Trainers required by Aug. 15, 1942	5,736	
On hand	2,954	
	2,782	short, which should be on hand July 15, 1942.
Advanced Single-engine Trainers required by Aug. 15, 1942	2,954	
On hand	Sufficient	
Bombardment Medium Airplanes required by Aug. 15, 1942	1,988	
On hand	Sufficient	
Observation Airplanes required by Aug. 15, 1942	341	
On hand	Sufficient	
Transport Airplanes required by Aug. 15, 1942	57	
On hand	Sufficient	
GRAND TOTAL TRAINING	28,400	

5. Again it is believed that the controlling factor is the availability of airplanes. The 4,195 Primary Trainers could be produced by June of 1943, based on current estimates.

II. "ULTIMATE" AIR FORCE.

6. Primary Training starts May 15, 1942 and requires a yearly pilot graduation rate of 108,528.

7. By initially operating at 50% of the desired technician strength the Primary School will be in full operation by July 15, 1942. The first full capacity class will graduate March 1, 1943.

The pilots available by March 1, 1943, based upon current plans will be:

31,320
1,320 - peace attrition
30,000 - by March 1, 1943

New pilots to graduate to include July 1, 1943, will be 36,136, or a total at that date of 66,136.

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The total requirements for pilots in tactical units is	73,360	
Pilots for flying schools	27,360	
Overhead	2,000	
	102,720	- Required by July 1, 1943
	66,136	- Available by July 1, 1943
	36,584	- Shortage by July 1, 1943

8. With monthly pilot production of 9,044 (the 108,528 rate), it will take four months to meet this shortage. Therefore, we can fully equip the contemplated program with pilots under these assumptions November 1, 1943.

9. In order to establish the 108,528 pilot graduation rate, we will need 72.3 type schools. To meet the dates indicated above we will need:

Primary Trainers required by March 15, 1942	10,845	
On hand	4,325	
	6,520	short, which should be on hand Feb. 15, 1942.
Basic Trainers required June 1, 1942	11,206	
On hand June 1, 1942	3,525	
	7,681	short, which should be on hand May 1, 1942
Two-engine Trainers required by Aug. 15, 1942	7,302	
On hand	2,954	
	4,348	short, which should be on hand July 15, 1942
Advanced Single-engine Trainers required by Aug. 15, 1942	3,760	
On hand	Sufficient	
Bombardment Medium Airplanes required by Aug. 15, 1942	2,530	
On hand	Sufficient	
Observation Airplanes required by Aug. 15, 1942	434	
On hand	Sufficient	
Transport Airplanes required by Aug. 15, 1942	72	
On hand	Sufficient	
Total airplanes for training	36,149	
Spares and reserve	902	
GRAND TOTAL TRAINING	37,051	

(Tab 12, Section II, Part III, Appendix II)

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10. Again it is believed that the controlling factor is the availability of airplanes. The 6,520 Primary Trainers could be produced by June of 1943, based on current estimates. (See Consolidated Table, Tab 1).

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J.B. No. 355
(Serial 707)

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A-WPD/1

TAB 13

PERSONNEL REQUIREMENTS

I. AIR CORPS PERSONNEL REQUIRED

A. "Interim Expedient" Air Force.

1. Assumptions:
   a. All technicians over and above those now set up for the 54 group program will be available for diversion to expanded training facilities.
   b. Money is available and orders for the expansion were issued September 1, 1941.
   c. Sufficient personnel is to be trained for double combat crew operation.

2. Flying School Establishment.
   a. Technicians required for 54 Group Program are on hand or now being trained in Technical Schools or Units.
   b. Technicians required for 30,000 Pilot Training Program will graduate from Technical Schools by April 30, 1942.
   c. An output of 9,000 technicians per month will be available for additional pilot training expansion starting in May, 1942.
   d. From present pilot training facilities.
      (1) Pilots available 3/1/43 — 31,320
      Less 2½% per year attrition — 1,320 (approx)
      30,000

      (2) 30,000 on hand 3/1/43
      28,412 increase from 3/1/43 to 7/1/43
      58,412 Total on hand 7/1/43

   e. (1) Pilots required for combat units — 61,623
      (2) Pilots required for Pilot Schools — 21,567
      (3) Pilots required for Overhead — 2,000
      Total — 85,190

   f. Shortage: e less d(1) equals 55,190.

   g. (1) Annual rate required for attrition — 85,236
      (2) Number schools required – 56.8 type schools

   h. Annual attrition rate governs.

   i. Expansion of Pilot Training.
      (1) Primary training can start May 15, 1942 and by operating with 50% of technicians required can be in full operation by July 15, 1942.

(Tab 13, Section II, Part III, Appendix II)

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(2) First full capacity class will graduate March 1, 1943.

j. Status on July 1, 1943.

Pilots required	85,190
Pilots on hand	58,412
Short	26,778

k. Time required to meet shortage:
Accrued shortage equals .....26,778 pilots
Monthly rate of production .....7,103 pilots
Time required to meet shortage..3.76 months
Date shortage could be met.....November 1, 1943

l. We can't go to war prior to November 1, 1943 without moving date of completion ahead in proportion to war time attrition.

m. Present set-up will be required to operate for six months on 50% of required technicians.

n. By providing 74.1 type Pilot Schools instead of 56.8 type Pilot Schools, program can be met by September 1, 1943.

3. Technical School Establishment.

a. If funds available September 1, 1941 new technical schools can open March 1, 1942.

b. Assumption has been made that required airplanes will be made available.

c. First graduates available 5½ months from March 1, 1942 or August 15, 1942.

d.

(1)	Technicians required for combat units	443,033
(2)	Technicians required for Pilot Schools	120,950 (56.7 type schs)
(3)	Technicians required for Technical Schools	35,000 assumed
		598,983

e. Shortage on 8/15/42 - 598,983 less 121,256 = 477,727
Technicians trained in existing schools 8/15/42 to 7/1/43 87,497
Shortage 390,230

f. From present technical training facilities

Technicians available 8/1/41	43,056
School graduates 8/1/41 to 8/14/42	78,200
	121,256

g.

(1)	Increase in annual technical training rate effective 8/15/42	446,592
(2)	Additional type schools - 22	
(3)	Annual technical training rate (output)	546,592

(Tab 13, Section II, Part III, Appendix II)

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J.P. No. 385
(Serial 707)

SECRET

A-WPD/1

4. Total Air Corps Requirements - (Consolidated Table No. 1).

AIR CORPS OFFICERS

Airplanes Type	Groups	No. of Operating Acs.	Pilots Per Ac.	Pilots No.	Monthly Pilot Attrit'n.	Navigators	Bombardiers	Obs. Gunner
B-29	(24)	1632	9.5	15504	2594	6528	3264	
B-17 & 24	(20)	3266	5.5	7480	1254	6532	3396	
	(27)		3.5	6426	315			
B-25 & 26	(10)	850	5.5	4675	787	1700	800	
Lt. Bomb.	(13)	757	1.5	1136	63	757	159	
Dive B.	(13)	1004	1.5	1506	84			
Pur. (I)	(54)	8970	1.5	13455	1014			
Pur. (F)	(6)	780	3.5	2730	441	780		1560
Obsn. (108 Sqs)		1521	1.5	2282	147	1521	506	1521
Photo	(2)	114	2.5	285	58			114
Transport	(32)	2048	3.0	6144	306	2048		
Total in Combat Units -		23934		61623	7063			
27 Tech. Schs.				648				
57 Fly. Schs. (a)				21660 (a)				
74 Fly. Schs. (b)		28400		28120 (b)				
Total other overhead				2000				
Grand Total		52334		83931 (a) 90391 (b)	7063	19866	8125	3195

AIR CORPS ENLISTED MEN — COMBAT CREWS

Airplanes Type	Groups	Bombardiers	Radio	Engr.	Arm.
B-29	(24)		6528	3284	3264
B-17 & 24	(20) (27)	1568	6532	6532	6532
B-25 & 26	(10)	450	1700	1700	1700
Lt. Bomb.	(13)	598			757
Dive B.	(13)				1004
Pur. (I)	(54)				
Obsn. (108 Sqs)		1015			1521
Photo	(2)		114	114	114
Transport	(32)		2048	2048	
Grand Total		3631	16922	13658	14892

(Tab 13, Section II, Part III, Appendix II)

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J.B. No. 355
(Serial 707)

SECRET

A-WPD/1

F. "Ultimate" Air Force.

5. Assumptions:

a. All technicians over and above those set up for 54 Group Program will be available for diversion to expanded training facilities.

b. Orders are issued and money is provided for the expansion on September 1, 1941.

c. Airplanes are manned for single combat crews.

6. Flying School Establishment.

a. Technicians required for 54 Group Program are on hand or now being trained in Technical Schools or Units.

b. Technicians required for 30,000 Pilot Training Program will graduate from Technical Schools by April 30, 1942.

c. An output of 9,000 technicians per month will be available for additional pilot training expansion starting in May 1942.

d. From present pilot training facilities
(1) Pilots available 3/1/43 31320
Less 2% per year attrition 1320 (approx)
30000

(2) 30,000 pilots on hand 3/1/43
36,136 pilot increase from 3/1/43 to 7/1/43
66,136 on hand 7/1/43.

e. (1) Pilots required for combat units 73360
(2) Pilots required for Pilot Schs. 27360
(3) Pilots required for overhead 2000
102720

f. Shortage: e less d (1) equals 72720

g. Annual rate of attrition including schools 108528

h. Schools required to sustain this rate: 108528 less 1500 equals 72.3

i. Annual rate of attrition governs.

j. Expansion of Pilot Training
(1) Primary training can start May 15, 1942 and by operating with 50% of technicians required can be in full operation by July 15, 1942.
(2) First full capacity class will graduate March 1, 1943.

k. Pilot output per month for 72.3 type schs. - 9,044

l. Status on July 1, 1943

Pilots required	102,720
Pilots on hand	66,136
Short	36,584

(Tab 13, Section II, Part III, Appendix II)

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m. Time required to meet shortage:
Accrued shortage equals ..... 36,131 Pilots
Monthly rate of production... 9,044 "
Time required to meet shortage. 4 Months
Date shortage could be met... Nov. 1, 1943

n. We can't go to war prior to November 1, 1943 without moving date of completion ahead in proportion to war time attrition.

o. Present set-up will be required to operate for six months on 50% of required technicians.

7. Technical School Establishment.

a. If funds available September 1, 1941 new technical schools can open March 1, 1942.

b. Assumption has been made that required airplanes will be made available from somewhere.

c. First graduate available 5½ months from March 1, 1942 or August 15, 1942.

d.

(1) Technicians required for combat units	443,033	
(2) Technicians required for Pilot Schools	120,950	(56.7 type schs)
(3) Technicians required for Technical schools	35,000	assumed
	598,983	

e. Shortage on 8/15/42 - 598,983 less 121,256 = 477,727
Technicians trained in existing schs.
8/14/42 to 7/1/43 87,497
Shortage 390,230

f.

From present technical training facilities	
Technicians available 8/1/41	43,056
School graduates 8/1/41 to 8/14/42	78,200
	121,256

g.

(1) Increase in annual technical training rate effective 8/15/42	446,592
(2) Additional type schools - 22	
(3) Annual technical training rate (output)	546,592

(Tab 13, Section II, Part III, Appendix II)

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J.B. No. 355
(Serial 707)

SECRET

A-WPD/1

8. Total Air Corps Requirements - (Consolidated Table No. 2)

AIR CORPS OFFICERS

Airplanes Type	Groups	No. of Operating Aps.	Pilots Per Ap.	Pilots No.	Monthly Pilot Attrit'n.	Navigators	Bombardiers	Obs. Gunner
4000 mile	(44)	2992	7.5	22440	3758	8976	2992	
B-29	(24)	1632	5.5	8976	1502	3264	1632	
B-17 & 24	(47)	3266	3.5	11431	1113	3266	1698	
B-25 & 26	(10)	850	3.5	2975	501	850	400	
Lt. Bomb.	(13)	757	1.5	1136	63	757	159	
Dive B.	(13)	1004	1.5	1506	84			
Pur. (I)	(54)	8970	1.5	13455	1014			
Pur. (F)	(6)	780	3.5	2730	441	780		1560
Obsn. (108 Sq.)		1521	1.5	2282	147	1521	506	1521
Photo	(2)	114	2.5	285	58			114
Transport	(32)	2048	3.0	6144	306	2048		2048
Air Base	(245)							
Air Depot*	(157)							
Total in Combat Units		23934		73360	8987			
27 Tech. Schs.				648				
72.3 Fly. Schs.		36149		27474				
Total other overhead				2000				
Grand Total		60985		103482	8987	21462	7387	3195

* 1 per 4000 mile Gp. and B-29 Gp.; 1 per two Gps., all other types.

AIR CORPS ENLISTED MEN -- COMBAT CREWS

Airplanes Type	Groups	Bombardiers	Radio	Engr.	Arm.
4000 mile	(44)		8976	5984	2992
B-29	(24)		3264	1632	1632
B-17 & 24	(47)	1568	3266	3266	3266
B-25 & 26	(10)	450	850	850	850
Lt. Bomb.	(13)	598			757
Dive B.	(13)				1004
Pur. (I)	(54)				
Pur. (F)	(6)				1521
Obsn. (108 Sq.)		1015			1521
Photo	(2)		114	114	114
Transport	(32)		2048	2048	
Air Base	(245)				
Air Depot	(157)				
Grand Total		3631	18518	13894	12136

(Tab 13, Section II, Part III, Appendix II)

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J.B. No. 355
(Serial 707)

SECRET

A-WPD/1

II. PERSONNEL REQUIRED - INCLUDING OTHER THAN AIR CORPS

(Consolidated Table No. 3)
For either "Interim Expedient" (a) or "Ultimate" Air Force:

		For Air Force Combat Units			For Units of Other Arms & Services on Duty with Air Force Combat Units.	
Airplanes Type	Groups	Non-flying Officers	Air Corps Technicians	Air Corps Non-technicians	Officers	E.M.
4000 mile (a)	(44)	1584	48488	26136	748	12892
B-29	(24)	864	26448	14256	408	7032
B-17 & 24	(47)	1692	51794	27918	799	13771
B-25 & 26	(10)	420	10920	5880	170	2930
Lt. Bomb.	(13)	455	9204	4953	234	5109
Dive. B.	(13)	455	9204	4953	234	5109
Pur. (I)	(54)	2754	45090	24246	810	10638
Pur. (F)	(6)	270	6354	3420	90	1182
Obsn. (108 Sq.	)	540	14796	7992	108	864
Photo	(2)	72	2204	1188	34	586
Transport	(32)	1024	18656	10048	160	640
Air Base	(245)	7595	149940	80605	8575	122500
Air Depot (b)	(157)	2198	49926	18369	1784	44919
Tot. in Combat Units		19923	443024	239964	14154	238172
27 Tech. Schs.		7344	66582	66582	1728	43200
56.7 Fly. Schs.		7484	120771	94008	1701	50519
74.1 Fly. Schs.		9781	157833	122857	2223	66023
Total other overhead		2000	25000	25000	500	5000
A. W. S.					750	150000
Miscellaneous		950	90000	90000		
Colored		800	80000	80000		
Grand Total		40798	862439	614403	19355	492395

(a) For "Interim Expedient" Air Force, subtract all personnel on 4000 mile line.
(b) One Air Depot Group for each Bomb. (H) Gp. and one Depot Group for each two combat groups of other types.

(Tab 13, Section II, Part III, Appendix II)

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III. PERSONNEL REQUIREMENTS -- SUMMARY

(Consolidated Table No. 4)

	"Interim Expedient" Air Force		"Ultimate" Air Force	
Officers				
Pilots	90,391		103,482	
Navigators	19,866		21,462	
Bombardiers	8,125		7,387	
Observers	3,195		3,195	
Non-Flying	39,214		40,798	
Services	18,607		19,355	
Total		179,398		195,679
Enlisted Men				
Technicians	813,951		862,439	
Non-Technicians	588,267		614,403	
Services	479,503		492,395	
Total		1,881,721		1,969,237
Grand Total		2,061,119		2,164,916

(Tab 13, Section II, Part III, Appendix II)

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J.B. No. 355
(Serial 707)

SECRET

A-WPD/1

TAB 14

PRODUCTION PROGRAM AIRCRAFT

I. GENERAL DISCUSSION.

1. Incontestable figures on the national capacity to produce aircraft under an "all-out" effort are almost impossible to derive from the currently available data on production. Because time limitations render it impracticable to assemble or develop more suitable data than that contained in O. P. M. Aircraft Report No. 8-F, dated July 18, 1941, the data contained in that report has been accepted at face value.

2. Because of the limitations imposed by management, labor, machine tool and raw materiel considerations, it is considered that for the next two years, the production rates given in 8-F, supplemented by the proposed "fill-in" program, are the maximum rates obtainable and that therefore the production shown in the next section hereof under the heading "National Aircraft Production Program" represents the maximum national output obtainable during the period July 18, 1941 - June 30, 1943.

3. Material increase in the rate of production after June 30, 1943 will necessitate the letting of purchase contracts in the immediate future.

4. Material change in the models of aircraft to be produced will result in a decrease in the overall rate of production and hence in the total quantities produced.

II. NATIONAL AIRCRAFT PRODUCTION PROGRAM.

5. The figures cited include only airplanes on contract under current procurement programs uncompleted as of July 1, 1941, plus airplanes approved for production or on new programs approved as of July 18, 1941, plus a "fill-in" program of those airplanes which could be built after the completion of currently planned programs without exceeding currently planned productive capacity. The "fill-in" program has no official status, but is included to indicate capacity that may be available for additional procurement of production items. Statistics are taken from O. P. M. Aircraft Report 8-F.

Military Use	Tactical	Trainer	Total
Army	25,290	18,133	43,320
Navy	7,683	186	9,544
Army Defense Aid	7,557	1,900	9,457
Navy Defense Aid	450	150	600
British	7,305	1,090	8,395
Other Foreign	578	186	764
Total Military	48,863	23,320	72,183 . . . 72,183

(Tab 14, Section II, Part III, Appendix II)

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Brought forward - Total Military Use		72,183
Commercial Transport Use		
United States	295	
Other Foreign	58	
Total Commercial Transports	353 . . .	353
Total Program (Excluding Fill-in)	72,536	
Fill-in Program	16,437 . . .	16,437
Grand Total	88,973 . . .	88,973

III. THE ARMY PROGRAM.

6. Pursuit Airplanes.—Present Army schedules contemplate the procurement of some 9600 airplanes by June 30, 1943. 1600 will be two-engine and the remainder single-engine. Allowing arbitrarily for a peacetime operational loss of about 1900, the Army should have on hand about 7700 pursuit airplanes. By the letting of "fill in" contracts, total procurement can be increased some 500 two-engine and 2300 single-engine airplanes. If these additional airplanes are allocated to the Army, the Army can have some 9900 pursuit airplanes in service by June 30, 1943.

7. Heavy Bombardment Airplanes.—Under present schedules, the Army will receive some 3400 heavy bombardment airplanes by June 30, 1943. Of this total, about 3300 will be fifty thousand pound airplanes, 2 will be seventy-five thousand pound airplanes and the remainder, (about 105), one-hundred thousand pound airplanes. Allowing arbitrarily for a loss of 500 airplanes due to peacetime operations, the Army should have on hand by June 30, 1943 some 2900 heavy bombardment airplanes. "Fill-in" orders will not appreciably affect the total quantity that can be obtained prior to 1 July, 1943, but will exercise a material influence on deliveries after that date.

8. Medium Bombardment Airplanes.—By June 30, 1943 the Army under present procurement programs will receive some 4400 medium bombardment airplanes. Allowing for the number now on hand and for an arbitrary loss of some 800 because of peacetime operations, the total in service by June 30, 1943 should be about 3700. The letting of "fill-in" orders at this time will increase total production some 1100 airplanes. If these additional airplanes are allotted to the Army, there will be in service on June 30, 1943 some 4600 medium bombardment airplanes.

9. Light Bombardment Airplanes (including dive bombers). Present procurement schedules provide the Army with some 1350 light and dive bombers by June 30, 1943. Considering the airplanes on hand and allowing arbitrarily for a loss of some 300 due to peacetime operations, the total in service on that date should be about 1050. By the letting of "fill-in" orders, the output of light and dive bombers can be

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increased some 1800 airplanes. If those additional airplanes are allocated to it, the Army will have some 2600 light bombardment and dive bombing airplanes. It is to be noted that present production schedules provide no reconnaissance airplanes as such. Current plans contemplate the utilization of a light bomber type for the purpose. The number of airplanes actually available for light bombardment purposes will therefore be dependent on the number of light bombardment airplanes utilized for reconnaissance purposes.

10. Observation Airplanes.—The Army is scheduled to receive 443 observation airplanes (C & D) by February 28, 1942. With an arbitrary peacetime loss total of 80, there should be some 350 on hand serviceable by June 30, 1943.

11. Transport and Amphibian Airplanes.— a. Under present schedules the Army will have received the following quantities of transports by the dates indicated:

Transports, 4-Engine –	Jan. 31, 1943	61
Transports, 2-Engine –	June 30, 1943	1235
Amphibians	Dec. 31, 1942	150

It is arbitrarily assumed that about 50 four-engine and 1000 two-engine transports and 90 amphibians will be in service by June 30, 1943.

b. By the letting of "fill-in" contrasts at this time, some 40 additional four-engine and 493 additional two-engine transports can be produced by June 30, 1943. If they are allocated to the Army, the Army should have in service some 80 four-engine and 1400 two-engine transports at that time.

12. Training Airplanes.— a. Under the present schedules, the Army will have secured the following airplanes by the dates indicated.

(1) Primary trainers: Aug. 30, 1942 – 4216. Estimated quantity on hand June 30, 1943, including those now in service: 5000.

(2) Basic trainers: June 30, 1943 – 5085. Estimated quantity then on hand, including those now in service: 5000.

(3) Advanced trainers: March 31, 1943 – 3033. Estimated quantity on hand June 30, 1943, including those now in service: 3100.

(4) Transition, crew and navigation trainers: March 1943 – 3606. Estimated quantity on Hand June 30, 1943, including those now on hand: 2800.

b. By letting "fill-in" orders the following additional trainers can be produced by June 30, 1943.

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(1) Primary trainers 3150
(2) Basic trainers 2123
(3) Advanced trainers 2095
(4) Transition, crew and navigation trainers . . . 2200

13. Attrition rates.—In deducing the number of airplanes the Army reasonably may be expected to have in service on June 30, 1943 under present production programs an arbitrary peace-time attrition rate has been employed that is somewhat less than the accepted war-time rate of 3% per month. The change in the method of building airplanes and the nature of the materiels used, as well as the intensive training pilots are receiving render the value of previous attrition tables somewhat doubtful. On the other hand, previous experience would indicate that for peace-time operations, an attrition rate of 3% per month is high.

14. Army Defense Aid Procurement.—The figures cited in this section for the Army Program do not include Army Defense Aid Procurement. To round out the Army Procurement picture as a whole the following totals of Army Procurement for Defense Aid are included.

Pursuit - 1E	Oct. 31, 1942	2413
Heavy Bomber	June 30, 1943	1000
Medium Bomber	Feb. 28, 1943	1250
Light & Dive Bomb.	Feb. 28, 1943	2359
Transport - 2E	Dec. 31, 1942	435
Transport - 1E	Jan. 31, 1942	100
Trainers, Adv.	Feb. 28, 1942	1600
Trainers, Basic	June 30, 1942	300
Total		9457

IV. ARMY AIRPLANES ON HAND - JULY 31, 1941.

15. The Army had on hand as of July 31, 1941 the following airplanes suitable for employment in the accomplishment of their basic missions.

Pursuit - Interceptor 457
Pursuit - Fighter 1
Heavy Bombers 70
Medium Bombers. 167
Light Bombers 121
Photographic 14
Transport 89

Training:

Primary 2080
Basic 1435
Advance - 1E 938
Advance - 2E 94

(Tab 14, Section II, Part III, Appendix II)

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V. NATIONAL MONTHLY PRODUCTION RATE.

The scheduled overall monthly production rate in June 1943, plus the production that would result from the "fill-in" program discussed in O.P.M. Report No. 8-F, is as follows:

Type	Procurement Program	"Fill-in" Program	TOTAL MONTHLY PRODUCTION RATE
Heavy Bomber	500	-	500
Patrol Bomber 4E	40		40
Medium Bomber	275	235	510
Patrol Bomber 2E	67	20	87
Light Bomber	50	355	405
Torpedo Bomber	45		45
Pursuit 2E	50	30	80
Pursuit 1E	294	491	785
Observation 2E			
Observation 1E		50	50
Transport 4E		8	8
Transport 2E	62	88	150
Transport 1E		17	17
Amphibian 2E			
Trainers, Crew		40	40
Trainers, Navigation			
Trainers, Transition		275	275
Trainers, Advanced		435	435
Trainers, Basic	25	350	375
Trainers, Primary		270	270
TOTAL.	1408	2664	4072

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J.B. No. 355
(Serial 707)

SECRET

A-WPD/1

TAB 15

FLYING WEATHER - ITS INFLUENCE IN ALL THEATERS

INDEX

Western Hemisphere. -- (Summaries).
- Iceland
- Greenland
- Newfoundland
- Alaska
- Bermuda
- Caribbean
- Northwestern South America
- Northern South America & Brazil
- Southern South America

Europe. -- (Summaries).
- British Isles
- Southern Europe
- Germany
- East Prussia & Poland

Pacific. --(Summaries).
- Hawaii
- Philippines
- South Sea Islands
- Australia and New Zealand
- Dutch East Indies

Asia. -- (Summaries).
- China
- Japan
- Burma, Siam and Indo China
- Siberia
- Russia

Near East and Africa. -- (Summaries).
- India
- Near East
- North Africa
- West Africa
- Central Africa
- South Africa

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THIS PAGE IS UNCLASSIFIED

J.B. No. 355
(Serial 707)

SECRET

A-WPD/1

WESTERN HEMISPHERE

ICELAND

General Flying Conditions: -- The weather is generally quite unfavorable for flying. The most favorable months for flying operations are June, July and August. During the remainder of the year and particularly in the mid-winter months, there are almost continuous storms centered over the Icelandic region. The yearly average cloudiness is between 6 and 8 tenths. During the winter months there are severe icing conditions almost continuously.

GREENLAND

General Flying Conditions: -- The east coast of Greenland has slightly better weather than Iceland. The west coast of Greenland has considerably better weather than the East Coast. For the east coast of Greenland the summer months are the most favorable for flying operations. In winter this region is subject to much low cloudiness, fog and frequent high winds of gale force. There is relatively little precipitation. For the west coast of Greenland the most favorable flying months are during the winter period when the average cloudiness is from 3 to 5 tenths. The summer months are marked by 6 to 8 tenths cloud cover and 2 to 4 inches of precipitation.

NEWFOUNDLAND

General Flying Conditions: -- The yearly average of flying conditions for this region is not great. Over the eastern district there is widespread and abundant fog throughout the entire year. The average summer cloudiness is about 6 tenths. The summer is relatively short, from the middle of April to the middle of September. During the winter period there is an abundant low cloudiness and frequent periods of stormy weather. This region lies in the path of most of the storms which originate in the United States and move off to the northeast. The winter period is marked by very poor flying conditions, when low ceilings and severe icing conditions will prevail much of the time.

ALASKA

General Flying Conditions: -- The region south and west of the mountain ranges is not favorable to flying operations during any period of the year. Frequent cloudiness and much precipitation marks this region. The most favorable months for this region are from June through August. North and east of the mountain ranges there is generally good flying conditions throughout the entire year with the best possible conditions prevailing from November through March. During this period there is an average cloud cover of from 4 to 6 tenths. There is relatively little precipitation, averaging something less than 2 inches per month.

BERMUDA

General Flying Conditions: -- Very good during the summer period from April to October; good during the winter period. During the winter period, there are occasional periods when storms generating off of the southeast coast of the United States move over the Bermuda area and may limit flying operations for several days.

(Tab 15, Section II, Part III, Appendix II)

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J.B. No. 355
(Serial 707)

SECRET

A-WPD/1

THE CARIBBEAN

General Flying Conditions: -- This area is marked by generally good flying weather the year around. The most unfavorable period for flying operations is during the months of August through November when this area may be subject to squally weather and hurricanes. During the winter there are occasional line squalls, but they are usually of little consequence to flying operations.

NORTHWESTERN SOUTH AMERICA

General Flying Conditions: -- Conditions limited by heavy rains and cloudiness in the mountainous regions from Panama through Ecuador. The best flying conditions could be expected during the period November through February. Heavy rains persist in the mountains and coastal region throughout the entire year.

NORTHERN SOUTH AMERICA AND BRAZIL

General Flying Conditions: -- Heavy rains particularly in the afternoon prevail along the north coast of South America with the maximum rainy season from January through June. The eastern part of Brazil does not lie in this heavy rain belt. Cloud cover decreases from west to east. Over the eastern half of Brazil and extending down to the area of Rio de Janeiro there is a marked decrease in the monthly average of cloudiness. The average cloud cover is from 4 to 5 tenths.

The east coast of Brazil has very favorable flying weather throughout the entire year. However, the winter period in that region south of Victoria may have periods of several days when flying operations would be limited.

SOUTHERN SOUTH AMERICA

General Flying Conditions: -- From Peru to central Chile the most favorable flying months are from November through March, but conditions are generally good throughout the entire year. Low stratus clouds will prevail along the coasts of Peru and Chile reaching a maximum in the period March through October; and there are frequent and widespread storms over the mountain ranges during the afternoon periods.

From southern Brazil to central Argentina flying conditions are most favorable from November through February, and are generally good throughout the entire year. This region is, however, frequently subject to weather disturbances during the period from April through September which would limit flying operations. The region of southern Chile and Argentina is generally very poor throughout the entire year, having continuous storms, cloudiness and precipitation.

(Tab 15, Section II, Part III, Appendix II)

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J.B. No. 355
(Serial 707)

SECRET

A-WPD/1

EUROPE

THE BRITISH ISLES

General Flying Conditions: -- The most favorable flying weather is in the period from March through June. This is commonly known as the dry period or when there is the least frequency of storms passing over the British Isles. The average sky cover for this period ranges between 6 and 7 tenths. Icing levels are quite low in March and April.

The rainy season starts in August and continues through January. Winter storms pass both north and south of the Islands and frequently center over the Islands. There is an abundance of low cloudiness and severe icing conditions. Throughout England there is much fog and poor visibility especially to the windward side of the industrial regions.

SOUTHERN EUROPE

General Flying Conditions: -- Northern France has weather very similar to that in western Germany and in southeastern England. The summers are favorable for flying whereas the winters will have frequent and long periods of poor flying weather. The central European region is marked by heavy cloudiness and much precipitation during the months from September through March. Flying conditions are poor during this period. During the summer period they improve considerably, but would be somewhat limited during the afternoon periods due to frequent convectional storms in the mountain regions.

Southern Europe is marked by good to excellent flying conditions during the months of May, June, July, August and September. There is very little cloudiness and rain over this region during this period. During the winter months, there is about 6 tenths average cloud cover and frequent periods when flying operations would be limited due to low clouds and low level icing conditions.

GERMANY -- METEOROLOGICAL REPORTS

TIME: -- Winter (December, January, February)

General Flying Conditions: -- Poor; frequent and long periods of low ceilings, poor visibilities, and severe icing conditions.

Cloud Cover: -- On the average more than 75%.

Ceilings: -- 50% are less than 3500 feet.
12% are between 3500 and 10,000 feet.
12% are between 10,000 and 25,000 feet.
26% are more than 25,000 feet.
(These statistics must be further interpreted. They indicate the percentage of the time when the ground is visible from the designated altitude. Decks of lower broken clouds may be expected most of the time. Hence, it is believed that not more than 5 to 10 per cent of the time will there be a ceiling of more than 20,000 feet.)

(Tab 15, Section II, Part III, Appendix II)

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Precipitation: -- An average of 15.3 days per month.

Thunderstorms: -- Rare; only an occasional one with a cold front passage.

Fogs: -- December: 6 days (20%)
January: 6 days (20%)
February: 5.2 days (17%)

Visibility: -- 25% of morning periods less than 2 miles.
15% of afternoon periods are less than 2 miles.

TIME: -- Autumn (September, October, November).

General Flying Conditions:-- September: Good
October: Fair, occasional periods bad weather.
November: Poor, frequent occasions of bad weather and winter conditions.

Cloud Cover: -- More than 6 tenths cover from Frisian Islands to Brocken.

Eastern and southeastern Germany have about 5 tenths cover in September, increasing through October and November.

Average cloud cover in November is about 75%.

Ceilings: -- 50% are 4000 feet or less.
15% are between 4000 and 20,000 feet.
9% are between 20,000 and 30,000 feet.
25% of the time the ground may be seen from 30,000 feet.
(These statistics must be further interpreted. They indicate the percentages when the ground may be seen from the designated altitude. Decks of lower broken clouds may be expected a great part of the time. Hence it is believed that not more than ten per cent of the time will a ceiling be found of more than 20,000 feet.)

Precipitation: -- An average of 14.6 days per month.
A decrease from west to east over Germany.

Thunderstorms: -- September: Few scattered.
October: Rare.
November: Rare.

Fog: -- September: 3 days, (10%)
October: 5 days (17%)
November: 6 days (20%)

Visibility: -- Approximately 20% of the time the visibility will be less than 2 miles during the morning period; 8% of the time it will be less than 2 miles all day. The industrial areas have greater frequency of poor visibility.

TIME: Summer (June, July, August).

General Flying Conditions: -- Good in western and northern Germany.

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General Flying Conditions (Continued): --
Excellent in southeastern district north of the mountains.
Fair in the mountainous region of southern Germany.

Cloud Cover: -- Approximately 6 tenths; somewhat less in the southeastern district; cumulous types of clouds prevail.

Ceilings: -- 50% are 9,000 feet or less.
10% are between 10,000 and 20,000 feet.
8% are between 20,000 and 30,000 feet.
32% are more than 30,000 feet.
(These above percentages should be somewhat modified, since they represent the percentage of frequencies when the ground was visible from the designated altitude. It is believed that not more than 10 to 15 per cent of the days will be found with a ceiling more than 30,000 feet.)

Precipitation: -- An average of 14.2 days per month.
Rain principally of the shower type. As many as 18 days per month in the Northwest district of Germany.

Thunderstorms: -- Very common.
Six per month at most stations during the months of June and July.
Frequency even higher in the mountains of southern Germany.

Fog: -- Rare.
Sometimes occurs during the morning periods in or near industrial areas.

Visibility: -- Fair to good.

TIME: -- Spring (March, April and May).

General Flying Conditions: --
March: Poor, frequent low ceilings, icing and fog.
April: Improving slowly.
May: Fair, approaching summer conditions.

Cloud Cover: -- Coastal Region averages 6.5 to 7 tenths.
Lowland central region 6 tenths.
Mountainous Region 7 to 7.5 tenths.

Ceilings: -- 50% are 5,000 feet or less.
14% are between 5,000 and 20,000 feet.
10% are between 20,000 and 30,000 feet.
26% of the time the ground may be seen from 30,000 feet.
(These statistical figures are subject to further interpretation. They indicate the percentage of frequencies when the ground is visible from the heights indicated. Therefore in view of the method of arriving at the above statistics it must be assumed that there are frequent conditions of visibility of the ground from a designated altitude in spite of a rather heavy cloud cover at a lower altitude. It is believed that not more than ten per cent of the days of this period will be found with an actual ceiling of more than 20,000 feet.)

(Tab 15, Section II, Part III, Appendix II)

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Precipitation: -- Average of 13 days per month.

Thunderstorms: -- March: An occasional thunderstorm.
April: An average of one at most stations.
May: An average of two to three at most stations.

Fog: -- March: Four days.
April: Two days.
May: One day.

Visibility: -- Frequent general low visibility during early morning. 10% of the days will have visibility of less than 2 miles.

EAST PRUSSIA AND POLAND -- METEOROLOGICAL REPORTS

TIME: -- Winter: November, December, January and February.

General Flying Conditions: -- Poor; frequent and long periods of low clouds, and poor visibility; severe icing conditions.

Cloud Cover: -- More than average 8 tenths cloud cover in most areas; days with little cloud are rare; clouds are generally of the sheet type and very low.

Ceilings: -- 60% are 1,000 feet or less;
12 to 15% are more than 8,000 feet.

Precipitation: -- Average 15 days per month; chiefly snow.

Thunderstorms: -- Rare.

Fog: -- November: 6 days (20%)
December: 5.5 days (18%)
January: 4.0 days (14%)
February: 3.4 days (11%)

Visibility: -- 25% of the mornings are less than 2 miles.
12 to 15% of the afternoons are less than 2 miles.

TIME:-- Autumn: September and October.

General Flying Conditions: -- Very good in September but becoming very limited in the latter part of October.

Cloud Cover: -- Broken cumulous types in September which become stratocumulous in October.
Low sheet type clouds are common in October.
Average cloud cover 6.3 tenths.

Ceilings: -- 25% are less than 1000 feet.
50% are less than 2000 feet.
25% are more than 3000 feet.

Precipitation: -- Average of 14 days per month.

Thunderstorms: -- One day in September; rare in October. More frequent in the Carpathian Mountains.

(Tab 15, Section II, Part III, Appendix II)

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Fog: -- September: 3 days (10%)
October: 4.9 days (16%)

Visibility: -- 12% of morning periods are less than 2 miles.
5% of afternoon periods are less than 2 miles.

TIME: -- Summer (May, June, July and August).

General Flying Conditions: -- Very good to excellent.

Cloud Cover: -- Average amount 5.8 tenths.
Broken cumuliform clouds predominate.

Ceilings: -- 15% are less than 1000 feet.
50% are 3500 feet or less.
35% are more than 8000 feet.

Precipitation: -- Considerable rainfall principally of the shower type.
Average of 14 days rain per month.

Thunderstorms: -- Normal Frequency of 5 per station per month.

Fog: -- May: 1.4 days
June: .96 days
July: 1.0 days
August: 1.3 days.

Visibility: -- Generally very good.

TIME: -- Spring (March and April).

General Flying Conditions: -- Coastal Region poor with progressive improvement.
Inland Region slightly better than coastal region.

Cloud Cover: -- Frequent periods of low clouds especially over the coastal region and the Carpathian Mountains.
Sky more than 8 tenths covered from 10 to 12 days of the month.

Ceilings: -- 50% are 3000 feet or less.
35% are more than 8000 feet.

Precipitation: -- 13.1 average days per month.
4 to 6 days snow in west region in March.
6 to 8 days snow in east region in March.
2 to 3 days snow in first part of April.

Thunderstorms: -- Rare in March.
Most stations report an occasional storm in April.

Fog: -- 3.2 days in March.
1.8 days in April.

Visibility: -- 10% of morning periods less than 2 miles.
3% of afternoon periods less than 2 miles.

(Tab 15, Section II, Part III, Appendix II)

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PACIFIC AREA

HAWAII

General Flying Conditions:-- Very good throughout the year. The average cloudiness is less than four tenths.

THE PHILIPPINES

General Flying Conditions:-- Flying is generally limited by the tropical nature of the weather. Certain local areas are greatly affected due to orographic features. The general period of heavy rains and storms is from June through December. The most favorable flying conditions may be expected from January through May.

U.S. SMALL ISLANDS

General Flying Conditions:-- The most favorable period for flying operations is from May through September. From November through April there is considerable cloudiness and frequent storms. The average cloudiness during this period is from six to seven tenths.

AUSTRALIA, NEW ZEALAND

General Flying Conditions:-- Generally excellent the year round. New Zealand and the western and northeastern parts of Australia have rather heavy rain and considerable cloudiness from December through March. In these areas during this period flying operations may be expected to be subject to frequent weather interruptions.

DUTCH EAST INDIES

General Flying Conditions:-- Flying operations could be expected to be somewhat limited throughout the entire year due to the heavy rains, squalls and violent thunderstorms. The morning periods should be found to be reasonably favorable for flying, and certain sections of the islands would have very good flying weather throughout the day. The average cloudiness is about six tenths with a marked increase after the noon hour.

ASIA

CHINA

General Flying Conditions:-- Best conditions should be expected during the months of December, January, February, March and April. There is little precipitation with the exception of the southeastern region, and the average monthly cloud cover should be from 3 to 5 tenths. During the months from May to December is the monsoon season when the region is usually marked by 6 to 9 tenths cloud cover, and has an abundance of precipitation.

(F.M 15, SECTION II, PART III, APPENDIX II).

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JAPAN

General Flying Conditions: -- Flying operations would be greatly limited during the summer months of March through November. This is the period marked by moist air, much cloudiness and frequent rain. The maximum rain and cloudiness period is the period June through July. The most favorable flying months are during the winter, However, there are regions of heavy precipitation on the islands during the winter months. There are frequent passages of storm centers from the South China Sea to the Bering Straits.

BURMA, SIAM AND INDO CHINA

General Flying Conditions: -- Reasonable clear sky conditions may be expected to prevail during the last half of November, December, January, February, March, April and May. Less than 4 inches of precipitation per month can be expected in December, January, February and March. The rains start increasing in April and reach a maximum of over 16 inches per month in August and September.

SIBERIA -- METEOROLOGICAL REPORTS

TIME: -- Summer: June, July, August.

General Flying Conditions: -- Arctic Region: Very good
West Central Region: Very good
East Central Region: Very good to Excellent
Amur and Southeastern Region: Very Good

Cloud Cover: --
Arctic Region: 10 to 15 per cent clear; 30 to 50 per cent overcast.
West Central Region: 10 to 15 per cent clear; 30 to 50 per cent overcast.
East Central Region: 10 to 15 per cent clear; 25 to 40 per cent overcast.
Amur and Southeastern Region: 8 to 10 per cent clear; 30 to 50 per cent overcast; along the coastal region and Kamchatka Island there is a high percentage of low overcast and coastal fog.

Precipitation: --
Arctic Region: An average of 14 days per month; light
West Central Region: An average of 14 days per month; light
East Central Region: An average of 9 days per month; light
Amur and Southeastern Region: An average of 10 days per month; moderate.

Thunderstorms: --
Arctic Region: None.
West Central Region: An average of 3 to 5 per month.
East Central Region: Rare.
Amur and Southeastern Region: An average of 2 to 3 per month.

Fog: --
Arctic Region: Occasional.
West Central Region: Rare.
East Central Region: Rare.

(Tab 15, Section II, Part III, Appendix II).

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Amur and Southeastern Region: Inland districts rate, but frequent and widespread areas along the coast from Vladivostok to the Bering Straits. Along this area there will be fog from 50 to 60 per cent of the month.

Remarks:-- The summer in Siberia is very short. During this period there is relatively warm weather with an average temperature of about 60 degrees Fahrenheit.

TIME: WINTER (September through May).

General Flying Conditions:-- Very good to excellent.

Cloud Cover:-- Arctic Region: 8 to 9 clear days per month.
West Central Region: 5 to 7 clear days per month.
East Central Region: 10 to 15 clear days per month.
Southern Region: Generally clear, average less than 4 tenths sky cover.

Precipitation: --

Arctic Region: Light; about ten days per month of snow.
West Central Region: Less than 1 inch per month; average of 8 to 14 days per month, principally light snow.
East Central Region: Less than 1 inch per month; average 5 to 10 days per month of light snow.
Amur and Southeastern Region: Less than 1 inch per month; average 2 to 8 days per month half of which is snow.

Thunderstorms: -- None in Arctic Region; occasional one in May and September in the West Central Region; none in the other regions.

Fogs: -- Few radiation types, more frequent heavy frost.

Remarks: -- Winters are extremely dry and cold. The average temperature through the Central Region is on the order of minus 30 to 40 degrees Fahrenheit for the mid-winter period.

RUSSIA -- METEOROLOGICAL REPORT

General Flying Conditions: --

January -- Fair; generally little precipitation but 7 to 8 tenths cloud cover.

February -- Fair;
Western Russia, 7 tenths average sky cover.
Eastern Russia, 4 to 6 tenths average sky cover.
Turkestan area generally clear.

March -- Fair to good;
Western Russia 6 to 7 tenths average sky cover.
Eastern Russia 4 to 5 tenths average sky cover.
Turkestan area clear to 4 tenths average sky cover.

April -- Good; Average sky cover from 5 to 6 tenths; less than 2 inches of precipitation.

May -- Good: Average sky cover of 5 to 6 tenths; 2 to 4 inches of precipitation.

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June -- Very good; average sky cover 5 tenths; 2 to 4 inche of precipitation.

July -- Very good; average sky cover 4 to 5 tenths; 2 to 4 inches of precipitation.

August -- Very good; average sky cover 4 to 5 tenths; 2 to 4 inches of precipitation.

September -- Very good; average sky cover 4 to 5 tenths; 2 to 4 inches of precipitation.

October -- Northern Russia: Poor; much low cloudiness, average 8 tenths sky cover.
Southern Russia: Good; average sky cover 3 to 6 tenths.

November -- Poor; average sky cover 7 to 8 tenths.

December -- Poor; average sky cover 7 to 8 tenths.

NEAR EAST AND AFRICA

INDIA

General Flying Conditions: -- Reasonably fair skies and favorable flying conditions may be expected during the last half of November, December, January, February and March. The Monsoons or rainy season begins in April and reaches a maximum of more than 16 inches per month in July. The rainy season may be expected to greatly limit flying operations. In northern India along the mountain ranges the rain is extremely heavy.

NEAR EAST

General Flying Conditions: -- The most favorable flying weather may be expected during the months of June, July, August, and September for the region around Asia Minor. There is very little rain and cloudiness during this period. From Asia Minor east to the border of India, flying conditions are very good to excellent during the entire year. The skies are generally clear and there is very little rain.

NORTH AFRICA

General Flying Conditions:-- Very good the year around. Occasional sandstorms will limit flying principally during the winter months.

WEST AFRICA (DAKAR--LIBERIA--MOROCCO)

General Flying Conditions: -- Very good to excellent conditions from Dakar north through Morrocco during the entire year. In the region of Sierre Leone and Liberia there is weather of a more tropical nature with considerably more rainfall and cloudiness. The wet season in this region is in the period from June through September, with the maximum rainfall in August.

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CENTRAL AFRICA

General Flying Conditions: -- Best conditions should be expected in November, December, January and February. The remainder of the year finds this area marked by moderate to heavy rains especially along the coastal region from Senegal to the Congo River. There is a maximum rainfall in June and September with heavy rains generally from April through October. Inland over the region south of the Sahara, conditions are quite favorable for flying the year around. Dense desert haze similar to fog, however, may limit flying for several days.

SOUTH AFRICA

General Flying Conditions: -- Along the west coast conditions are reasonably good during the entire year, but most favorable from April through October. From November through May, there is an increase in rainfall. Along the east coast and in the central region, there is heavier rainfall and considerably more cloudiness during the entire year. The best months for flying operations are May through September.

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Tab 16

COMPARISON OF MUNSTER AAF FORCES

On July 1, 1942 (Assuming RAF will be approaching ultimate strength)

GAF WILL HAVE (Tab C):		GAF, IN U.K. WILL HAVE (Tab G):		AAF vs. GERMANY (See Tab D)	RAF+AAF	Percent Superiority of GAF over RAF	over AAF	over RAF+AAF
Bombers	7,464*		4,464*	0*	4,464	62%		6.7%
Dive Bombers	1,075		-	-	-	-	-	-
Fur. (1-Eng.)	4,092	Fighters S/R	3,744	1,680	3,744	146%	144%	22%
Fighters(2-Eng.)	1,972	Fighters L/R	840	2,880 400	1,240	208%	393%	90%
		Torpedo Bombers	120	-	120	-	-	-
		Sonts-Gen. Ren	117	-	117	-	-	-
		Gen.Ren.Land Aps	320	-	320	-	-	-
Total Combat	15,364		9,325	4,080	13,405	110%	64%	83%

* Including 800 130-plane better than B-17's (over 1000 of RAF)

* Including dive bombers and including less than 100 (-2's. Note RAF bomber strength must be less than 4464 - see next column.

* To support 4464 RAF bombers, 1100 replacements per mo. are required - U. S. can mfg. 900 U.K. can mfg. 500/mo by 7/1/43.

In lieu - 2

Keep "Interim Expedient" AAF in complete - and RAF (as reached Ultimate strength - and GAF not expanded at all beyond estimated July 1, 1943, strength:

GAF WILL HAVE:		RAF, IN U.K. WILL HAVE		AAF vs. GERMANY (See Tab D)	RAF+AAF	Percent Superiority of GAF over RAF	over AAF	over RAF+AAF
Bombers	7,464*		4,464	1,842*	4,306	62%	89%	-15% (GAF inferior)
Dive Bombers	1,075			-		-		
Fur. (1-Eng.)	4,092	Fighters S/R	3,744	1,680(SI)	3,744	146%	144%	22%
Fighters(2-Eng.)	1,972	Fighters L/R	840	2,880 400(NI)	1,240	208%	393%	90%
		Torpedo Bombers	120	-	120			
		Sonts-Gen. Ren.	117	-	117			
		Gen. Ren. Land Aps.	320	-	320			
Total Combat	15,364		9,325	4,922	13,447	110%	159%	16%

* Incl. 800 better than B-17

* Incl. Dive Bombers, also incl. 7 Sterling's (Superior to B-17's)

* Incl. [illegible] or 24, 1632 B-29's and 2392 4000 mi. radius of action Airplanes

In lieu - 3

Keep "Interim" AAF in complete - and RAF (as reached Ultimate strength - and GAF not expanded at all beyond estimated July 1, 1943, strength:

GAF WILL HAVE:		RAF, IN U.K. WILL HAVE		AAF vs. GERMANY (Tab I)	RAF+AAF	Percent Superiority of GAF over RAF	over AAF	over RAF+AAF
Bombers	7,464*		4,464*	0,834*	4,298	62%	6%	-39%
Dive Bombers	1,075		-	-		-		
Fur. (1-Eng.)	4,092	Fighters S/R	3,744	1,680(SI) 4,080	3,744	146%	144%	22%
Fighters(2-Eng.)	1,972	Fighters L/R	840	400(NI)	1,240	208%	393%	90%
		Torpedo Bombers	120	-	120			
		Sonts-Gen.Ren	117	-	117			
		Gen.Ren.Land Aps	320	-	320			
Total Combat	19,384		7,325	8,914	17,089	110%	84%	-11%

* Incl. 800 better than B-17

* Incl. Dive Bombers, also incl. 7 Sterling's (Superior to B-17's)

* Incl. 850 B-25 or 26, 1360 B-17 or 24, 1632 B-29's and 2392 4000 mi. radius of action Airplanes

(Tab 16, Section II, Part III, Appendix II)

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Tab 17

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DISCUSSION--PRODUCTION REQUIREMENTS FOR HEAVY BOMBS

I. Scope

1. In order to gage the magnitude of the production problem involved in carrying out this program, an investigation has been made into the airplane production capacity of the nation to deliver heavy bombers.

2. Heavy bombers are believed to be the critical item in meeting the program, since they require the maximum productive effort per article, and also comprise the major portion of the offensive aircraft required.

II. Assumptions

3. In order to be as realistic as possible in making this computation, the following assumptions have been made:

a. 1st Priority requirement: provisions of one group of heavy bombers for the Philippines -- at first aviation objective strength -- 35 airplanes.

b. 2nd Priority requirement: provision of three groups of heavy bombers for use in England, under the provisions of ABC-1.

c. 3rd Priority requirement: provision of ten groups of heavy bombers for defense of the Western Hemisphere and our island possessions, as follows, at 35 airplanes per group:

Philippine Islands	1 Group
Newfoundland	1 Group
Iceland or Greenland	1 Group
Panama	1 Group
Hawaii	2 Groups
Alaska	1 Group
United States	1 Group
British Guiana	1 Group
Brazil	2 Groups

d. 4th Priority requirement: bring all (11) groups in Hemisphere Defense and the Philippine Islands to 2nd Aviation strength (68) without reserves.

e. 5th Priority requirement: Bring 3 groups in England up to 2nd Aviation strength with 25% reserves. (Total 85 airplanes per group.)

(Tab 17, Section II, Part III, Appendix II)

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f. 6th Priority requirement: Add new groups to the offensive force in Europe and the Near East, at second aviation strength (85 airplanes each) until the total number of heavy groups in Europe and the Near East reaches 44.

g. 7th Priority requirement: Build up Hemisphere Defense and Philippine groups to 85 airplanes each, and add to these groups till they total 127 groups at 85 airplanes each.

h. IT IS ASSUMED THAT ACTION OR PLANS WITH RESPECT TO [illegible] GROUPS IN EUROPE AND THE NEAR EAST BY THE END OF 1942.

i. Attrition for units in Europe and the Near East is at 20% per month from April 1942 till July 1944. Thereafter attrition for these units is at 40% per month.

j. Attrition of all other units is at 5% per month.

k. Fifteen percent of all heavy bomber production for the Army has been deducted for export, in accordance with A-WPD/2.

III. Basis for Estimates (See two charts "Monthly Production Rate B-" and "Rate of Activation of Heavy Groups")

4. Production rates have been based upon existing production schedules up until June 30, 1943. Thereafter they have been based upon reaching peak capacity (1250 per month) by April of 1944, and stabilizing at that rate. It is believed possible to reach that rate by April 1944 if the decision is reached immediately to undertake this effort, and if this goal is given FIRST OF NATIONAL PRIORITY. It will probably involve immediate steps to construct about seven new government-owned heavy bomber factories.

IV. CONCLUSIONS.

5. Consideration of the results of this computation leads to the conclusion that:

a. It is within the capacity of the nation to implement this plan.

b. That the air offensive can be initiated in April of 1942.

c. That it can reach its full power by April of 1944.

d. That it can be sustained at its full power.

(Tab 17, Section I, Part III, Appendix II)

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g. That this will involve production of 10,863 heavy bombers for the Air Corps by May of 1944, and will require a production rate of 1070 airplanes per month thereafter.

V. ACTION NECESSARY TO FULFILL PROGRAM.

6. That action be taken immediately to provide aircraft productive capacity of 1250 heavy bombers per month by April 1944.

7. That this project be given priority over all other national production requirements.

(TAB 17, SECTION II, PART III, APPENDIX II)

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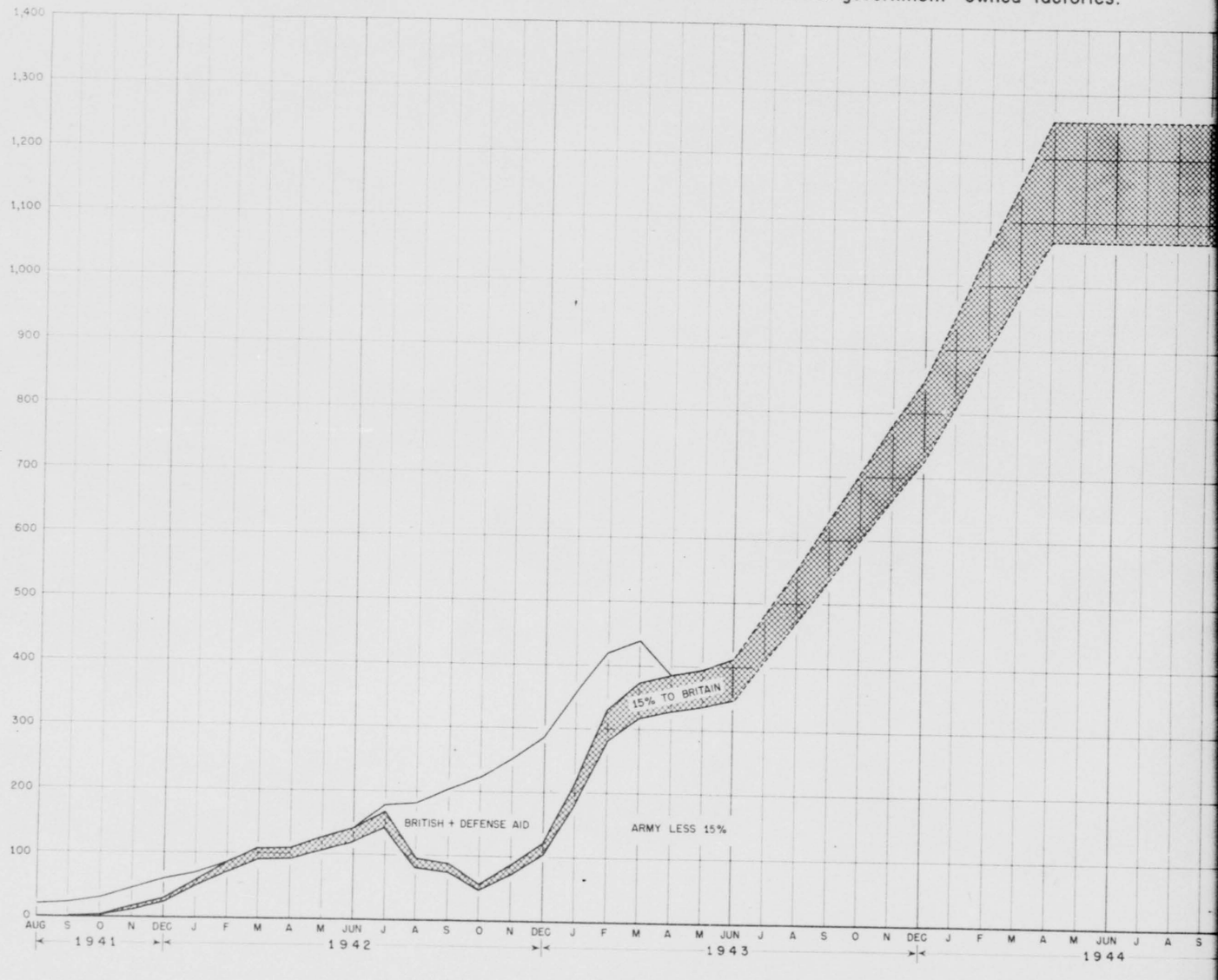
MONTHLY PRODUCTION RATES - HEAVY BOMBERS

Based on present schedules until June 30, 1943, thereafter on maximum possible production rate contingent upon immediate decision to build seven additional government-owned factories.



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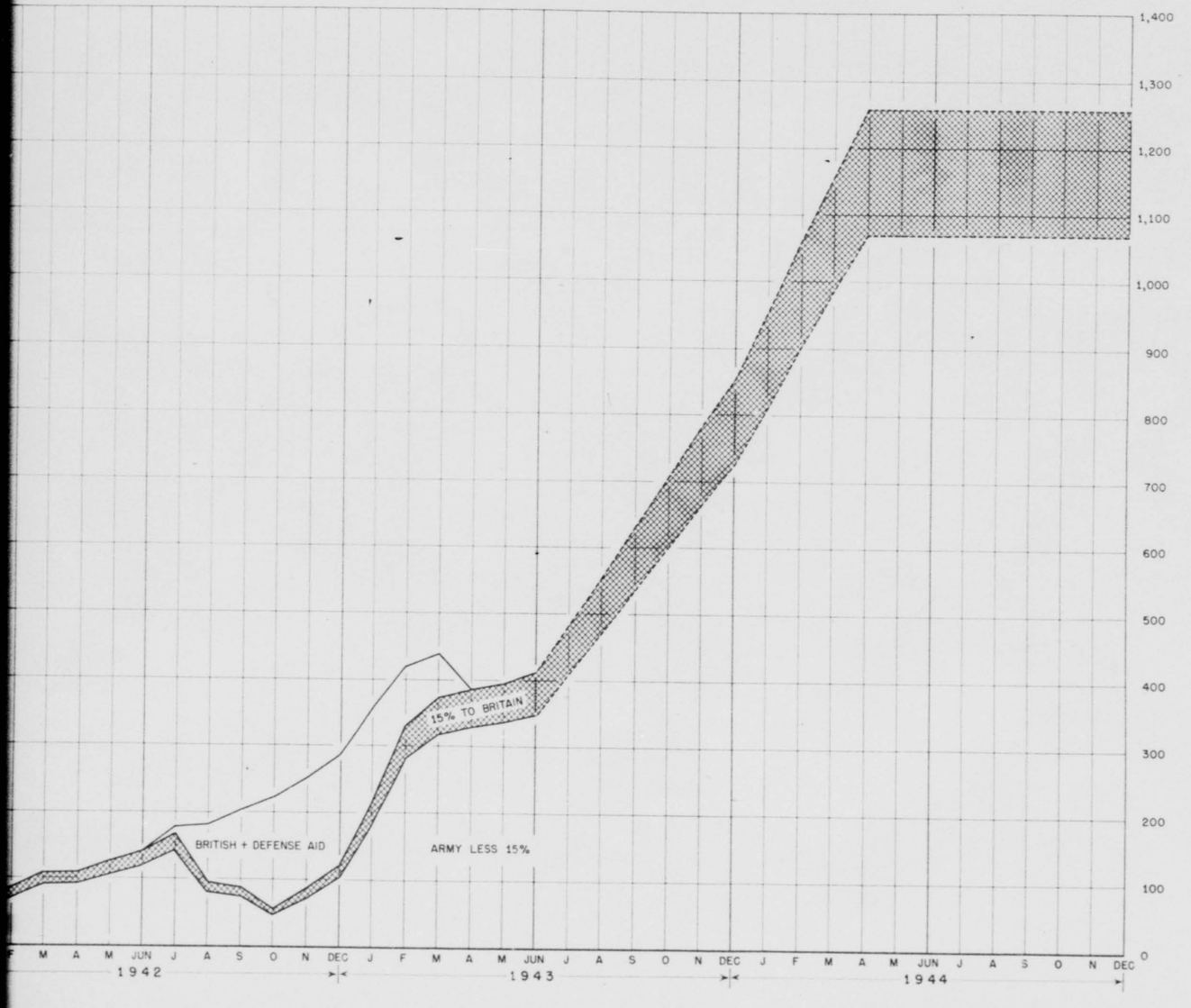
MONTHLY PRODUCTION RATES - HEAVY BOMBERS

ased on present schedules until June 30, 1943, thereafter on maximum possible production rate contingent upon immediate decision to build seven additional government-owned factories.



TAB 17(a)
(Section II, Part III, Appendix II)

STATISTICS SECTION - 9/30/41

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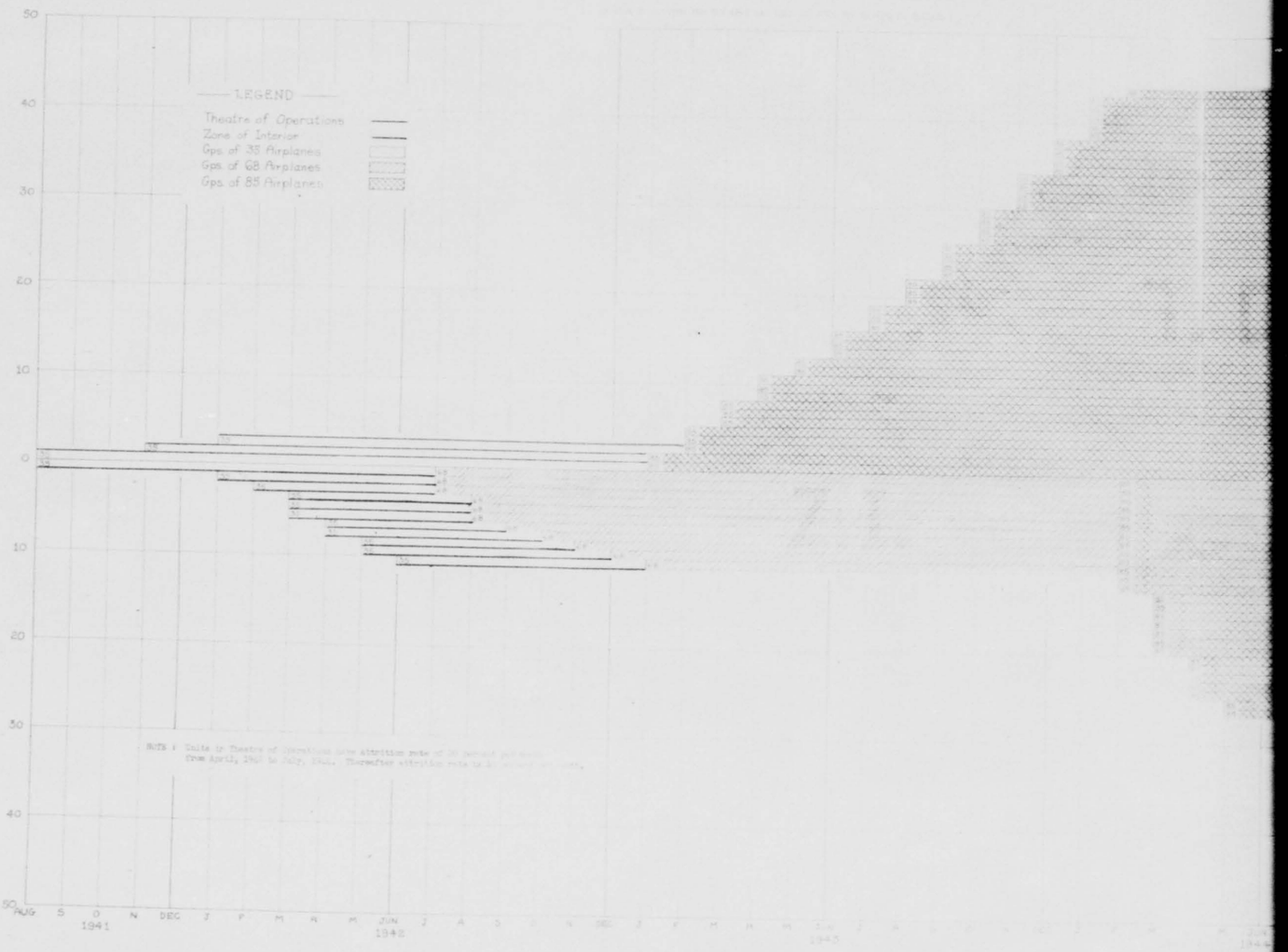

NOTE : Units in Theatre of Operations have Attrition rate of [illegible] per month from April, 1942 to July, 1942. Thereafter attrition rate is [illegible] per month.

THEATRE OF OPERATIONS

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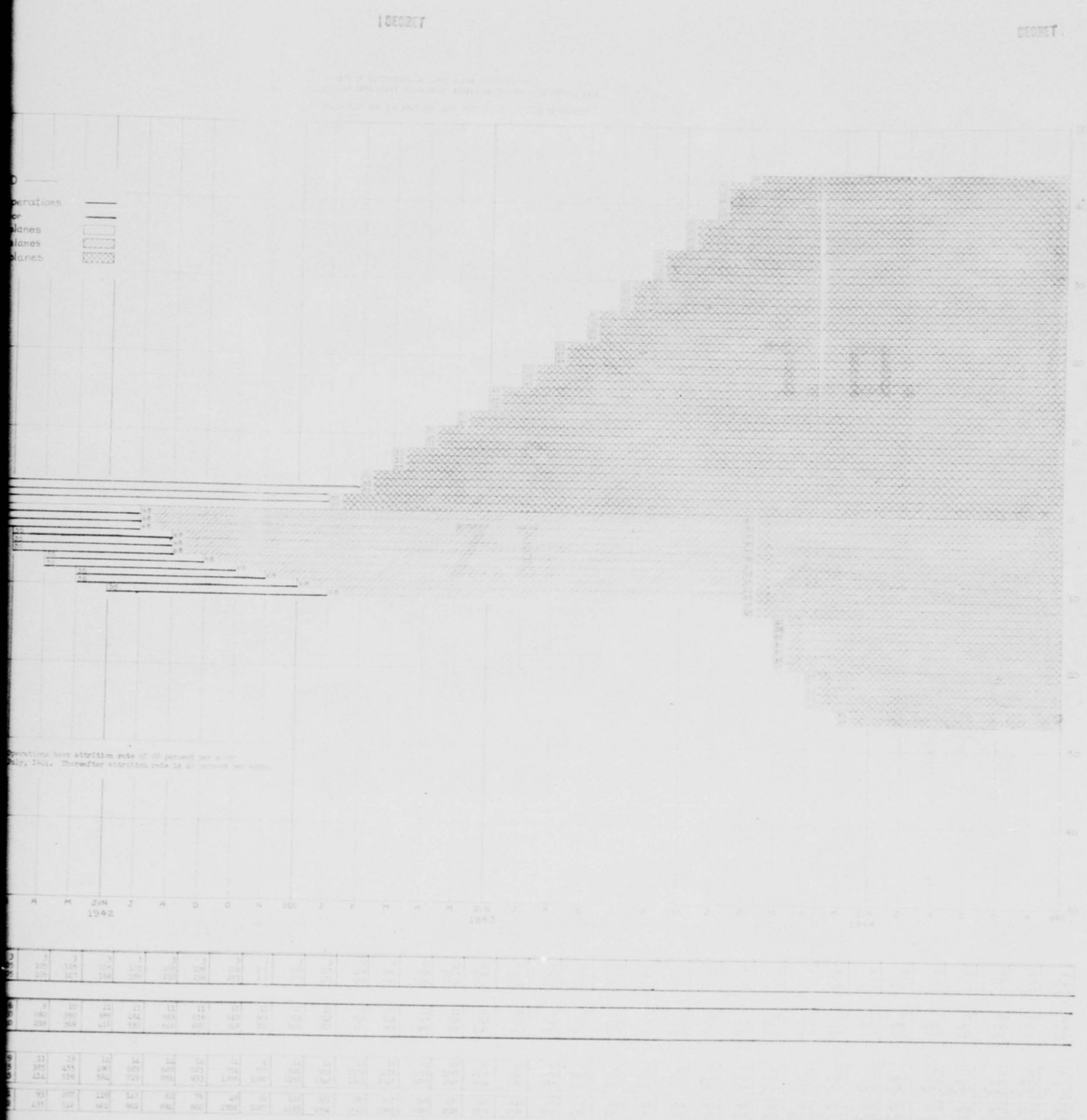

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ENGINEER EQUIPMENT

REQUIREMENTS FOR SPECIAL TROOP BASIS

U. S. Estimate of Needs of Foreign Nations - For Planning Purposes Only

THIS LIST INCLUDES CRITICAL ITEMS ONLY

Item No.	Item	Unit Cost	Army Ground Force	Army Air Force	Navy	Great Britain	Latin America	Russia	China	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1	Boat, power, with trailer	5,000	289				200			489
2	Bridge, steel, portable, M-10	5,000				26	60			86
3	Bridge, steel, portable, M-20	8,000								0
4	Bridge, steel, portable, trestle	50,000	41							41
5	Camera, copying, motorized	16,000								0
6	Compass, lensatic, w/case	9	156,820							156,820
7	Compass, prismatic, w/case	14	81,175							81,175
8	Crane, truck mounted	18,000	421							421
9	Electric lighting equipment, 3 KVA (generator only)	600	1,716				100			1,816
10	Electric Lighting equipment, 5 KVA (generator only)	900	677			100				777
11	Explosive, TNT, pounds	.60	4,895,010			3,021,760				7,916,770
12	Explosive, ammonium nitrate, lbs.	.20	5,070,000							5,070,000
13	Ferry, portable, 30 ton	70,000	86			22				108
14	Footbridge, Model 1938	8,000	155				200			355
15	Instruments, drawing, office set	40	5,710							5,710
16	Instruments, drawing, field set	30	3,400							3,400
17	Map Reproduction equipment, Hq.	6,000								0
18	Map Reproduction equipment, Mtzd.	16,000								0
19	Mobile Reproduction Equipment, Topographic Co. (Corps)	80,000	26							26
20	Mobile Reproduction Equipment, Reproduction Co. (Topo Bn)	225,000	14			4				18
21	Multiplex Projection Equipment	300,000	20							20
22	Planimeter, polar, Amsler's	100	584							584
23	Pontoon Bridge, 10 ton	75,000	202			26	100			328
24	Pontoon Bridge, 25 ton	130,000	196			5	40			241
25	Reproduction equipment, Litho. Plat., Repro. Co. (Topo Bn)	100,000	21							21
26	Saw, Timber, Gas-motor Operated	600	2,676				60			2,736
27	Searchlight, 18" (Beach Defense)	600								0
28	Searchlight, 24" (Beach defense)	10,000								0
29	Searchlight, AA, 60", Mobile	25,800	4,490				150	2,000	300	6,920
30	Searchlight, AA, 60", Portable	21,000								0
31	Shovel, gasoline, 3/8 yard	9,000	210							210
32	Shovel, gasoline, 1/2 yard	12,000	469							469
33	Shovel, gasoline, 3/4 yard	14,000	4							4
34	Special Equipment, Aviation	200,000	82							82

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(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
35	Stereocomparagraph Equip., Set	400	837							837
36	Stereoscope, magnifying, lens-prism	1,100	75							75
37	Stereoscope, magnifying, mirror, with binoculars	225	5,582							5,582
38	Theodolite	2,000	1,066				100			1,166
39	Trailer (for medium tractor)	2,000	2,909			114				3,023
40	Trailer, tilting (for light tractor) and searchlight	1,750	1,460							1,460
41	Trailer, (for triangulation tower)	1,300	369							369
42	Transit, Engineers, 1-minute	400	760				100			860
43	Transit, Engineers, 20-second, with night illumination	525	1,935			201				2,216
44	Triangulation tower, portable	750	184							184
45	Water Purification Unit, Mobile	10,000	357			12				369
46	Water supply equipment, Engineer	3,500	1,189			143				1,332
47	Water supply equipment, water supply Battalion	6,000	19				50			69

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ORDNANCE EQUIPMENT

REQUIREMENTS FOR SPECIAL TROOP BASIS

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(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	COMBAT VEHICLES									
1	Tank light M3 (w/o armament)	40,925	32,444		281	4,000	500	1,000	120	38,118
2	Tank medium M3 (w/o armament)	74,970	12,537			13,009		800		25,846
3	Tank heavy (w/o armament)	125,000	994			1,500				2,494
	MISC. FIRE CONTROL EQUIPMENT									
4	Finder range 1 meter base	2,000	3,510		114		300		248	4,172
5	Finder range 80cm.	1,250	4,341		240					4,581
6	Circle aiming M1 FMP	700	14,400		39		300		486	15,225
7	Board plotting flash ranging	3,000	37							37
8	Board plotting sound ranging M1	3,000	37							37
9	Compass M2	20	12,673				20,000			32,673
10	Corrector wind sound ranging	400	37							37
11	Quadrant gunners' M1 FMP	48	24,350		269		60			24,679
12	Binoculars M3	70	252,933			11,249	10,000		1,240	275,422
13	Telescope B. C.	1,200	7,401		60		200		376	8,037
14	Instrument Azimuth mils M1918	-	0		8		100			108
15	Telescope observation M4 Inf-Cav.	83	1,494							1,494

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REQUIREMENTS FOR SPECIAL TROOP UNITS

U. S. ESTIMATE OF WORLD OF POSTWAR NATIONS. PLANNING PURPOSES ONLY.

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Item No.	Critical Item		Unit Cost	Army Ground Force	Army Air Force	Navy	Great Britain	Latin America	Russia	Other	Total
(1)	(2)		(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	FIELD ARTILLERY MATERIEL										
1	Gun 75mm M1897A4 w/Carr M2A3 AT		$ 17,000	2,706		50		100		114	2,970
2	Gun 75mm AT w/self propelled mount	Mod.	21,400	432							432
3		New	25,200	14,241			3,900				18,141
4	Gun 75mm tank M3		4,500	12,115			13,409		500		26,024
5	Recl artillery		1,657	0							0
6	Cart artillery		1,749	0							0
7	Howitzer 75mm M1A1 - field		13,000	42				300			342
8	Howitzer 75mm M1A1 - pack		11,900	760		42		600		100	1,502
9	Caisson light 75mm field how mun.		500	0				300			300
10	Limber light 75mm field how mat.		650	0				600			600
11	Gun 3" tank - heavy		7,000	954			1,500				2,454
12	Gun 3" Antitank - wheeled		37,000	0							0
13	Gun 3" antitank - self-prop.mount		24,000	0							0
14	Howitzer 105mm M2A1 - field		20,000	5,449				150	2,500		8,099
15	Howitzer 155mm field hi-speed	)	2,000	0		20					20
16	Howitzer 155mm M1	)	33,000	1,289			160	80	1,200		2,729
17	Gun 155mm field hi-speed	)	3,000	0		48					48
18	Gun 155mm field M1	)	52,000	0			100	40			140
19	Gun medium field 4.5"		35,000	115			300				415
20	Mount self-prop f/155mm Gun		25,000	0							0
21	Gun 4.5" AT -self-prop.mount		41,000	0							0
22	Howitzer 8" field M1		52,000	0							0
23	Gun 8" field		116,000	0							0
24	Howitzer 240mm field (new)		116,000	0							0
25	Gun 8" railway (Navy)	FMF SCD	90,000	0							0
26	Gun 8" railway w/ped.mt.(Navy)	(SCD)	85,000	0							0
27	Gun 8" railway M1918 (Army)	FMF SCD	195,000	0							0
28	Car ammunition 8" Ry. Gun M2	FMF SCD	7,500	0							0
29	Car machine shop Ry Arty Gun		33,000	0							0
30	Mortar 12" Ry (SCD-Ry.Ctre)	FMF	96,795	0							0
31	Car ammunition 12" Ry. Mortar		7,500	0							0
32	Car fire control Ry Arty M3		7,500	0							0

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Item No.	Critical Item	Unit Cost	Army Ground Forces	Army Air Force	Navy	Great Britain	Latin America	Russia	China	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	ANTIAIRCRAFT MATERIEL									
1	Gun machine cal..50 Brp M2 W/C AA	$ 1,800	5,112		1,490	4,500	150	10,000		21,260
2	Mount cal..50 M2 - AA M5	910	3,957		168		150	10,000		14,271
3	Mount pelestal cal..50 AA M1 A4F	910	0							0
4	Equipment control cal..50 AA M5	3,000	0		39		40			79
5	Gun 37mm M1A2 automatic AA M9	20,000	6,080		58		200			6,338
6	Gun 37mm automatic w/self propelled mount	40,000	2,143			1,200				3,343
7	System remote control M1 37mm AA G	3,000	8,223		276					8,499
8	Unit generating M5 - 37mm AA Gun	1,000	8,223							8,223
9	Director AA M5 - 37mm AA Gun	7,500	7,487		214		200			7,901
10	Equipment control - 37mm AA Gun	2,500	0							0
11	Gun automatic 40mm AA	21,000	1,441			1,000		7,000	180	9,671
12	System remote control M3 -40mm AA G	3,000	2,227					7,000		9,227
13	Unit generating M - 40mm AA Gun	1,000	2,227					7,000		9,227
14	Director AA M6 - 40mm AA Gun	7,500	2,227			1,000		7,000		10,227
15	Gun AA mobile 3"	35,000	0		100		100			200
16	Gun 90mm AA mobile	50,000	1,200			1,245		3,000	48	6,493
17	System remote control M2 -90mm AA G	37,500	400					1,000		1,400
18	Unit generating M6 (3" AA)	1,000	0							0
19	Unit generating M7 - 90mm Gun	6,000	600					1,500		2,100
20	Director AA 3" - 90mm M4	30,000	400		15	580	25	1,000		2,020
21	Gun 4.7" AA	85,000	0							0
22	System remote control M4 -4.7" Gun	37,500	0							0
23	Unit generating 4.7" Gun	6,000	0							0
24	Director AA 4.7" AA Gun	30,000	0							0
25	Finder height AA - M1 and M2	27,500	0		15	529	25	1,000		1,569
26	Instrument binaural training	650	0		27					27
27	Instrument flank spotting	300	0		39					39
28	Instrument observation AA BC M1	1,400	0		66		25	1,800		1,891
29	Locator sound M2 complete	6,000	0		12		130		300	442
30	Rule flank spotting	150	0		9					9
31	Tester stereoscopic M1A1 complete	140	0		14	300		1,000		1,314
32	Trainer stereoscopic M2 complete	1,500	0		20	10	8	250		
33	Altimeter complete		0		250					250

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(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	SMALL ARMS AND INFANTRY WEAPONS									
1	Gun 57mm antitank M1	$ 4,500	26,280		21	4,703	350	5,000	350	36,706
2	Gun 57mm antitank -self propelled mount	6,000	4,965							4,965
3	Gun 57mm tank M5 and M6	2,000	41,897		466	18,509	200	1,500		62,572
4	Mortar 60mm w/mount M2	500	6,965		46		1,000	4,500		12,511
5	Mortar 81mm w/mount M1 - C.V.									
6	Mortar 81mm w/mount M1 - Pack	800	5,448		124	2,207	400	2,000		10,179
7	Mortar 81mm w/mount M1 - M.									
8	Rifle US cal..30 semiauto M1	80	1,929,138		37,236	1,197,000	45,000	25,000		3,233,374
9	Helmet steel	4	5,340,975		60,000		100,000		52,724	5,552,699
10	Projector signal ground M3 & M4	5	16,971							16,971
11	Pistol Very 10-gage	20	23,842			5,000				28,842
12	Mount MG truck pedestal M24	50	18,583		288					18,971
13	Rifle auto Fry M1918A2	200	41,016							41,016
14	Rifle auto Fry M1918 -cal..30	200	13,323				10,000			23,323
15	Pistol auto cal..45 M1911A1	45	2,784,829		14,536		8,000		46,482	2,853,847
16	Light Rifle	-	-							0
	AUTOMATIC WEAPONS									
17	MG cal..30 Fry M1917A1 W/C -C.V.	500								
18	-Pack	550	201,351		5,315		5,000			211,666
19	-GAAA	500								
20	Mount triped MG M1917A1 W/C-C.V.									
21	-Pack	100	117,414		1,395		5,000			123,809
22	-GAAA									
23	MG cal..30 Fry M1919A4 (fixed)	745	37,317			33,018		2,000		72,335
24	MG cal..30 Fry M1919A4 (flex)-C.V.	745								
25	Pack	817	255,394		3,665	49,989		7,000		316,048
26	GAAA	745								
27	Mount triped MG MG - C.V.									
28	Pack	75	122,315		300	37,674		3,000		163,289
29	GAAA									
30	MG cal..50 Fry HB (fixed)	1,400	3,441							3,441
31	MG cal..50 Fry HB (flex) - C.V.	1,400								
32	Pack	1,500	108,547		852	35,000	3,000	5,000		152,399
33	GAAA	1,400								
34	Mount triped MG MG - C.V.									
35	Pack	100	91,693		168	5,000	3,000			99,861
36	GAAA									
37	Gun submach cal..45 Thompson CF (M1928A1)	200	344,707		1,956	34,518	5,000	22,000		408,181
38	Wtc									

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	AIR CORPS REQUIREMENTS									
	SMALL ARMS & CANNON AMMUNITION									
1	Cart cal..30 AC Ball (per M)	46.00					700,000	18,900	12,390	731,290
2	Cart cal..30 AC AP (per M)	75.00			735,700	217,000		18,900	24,466	996,066
3	Cart cal..30 AC Tracer (per M)	65.00			362,400	54,750	300,000	9,450	32,446	758,546
4	Link met belt cal..30 (per M)	6.00			1,040,500	271,250			69,682	1,381,232
5	Cart cal..50 AC Ball (per M)	190.00					3,000,000		4,056	3,004,056
6	Cart cal..50 AC AP (per M)	250.000				837,900		241,164	8,070	1,087,134
7	Cart cal..50 AC Tracer (per M)	225.00				209,474	1,000,000	60,291	8,070	1,277,765
8	Link met. belt cal..50 (per M)	15.00				1,047,374			20,175	1,067,549
9	Shell 37mm AC	4.21		7,745,500		3,150,000				10,895,500
10	Shell 20mm AC HE	.80		25,240,000	202,500	2,520,000	25,000			27,987,590
11	Shell 20mm AC AP	1.56		34,156,556	255,500	5,790,000	35,000			40,226,056
	BOMB & AC FUZES/INCLUDES									
12	Cart signal AC assrtd W11,14,15 A16	1.95		50,767,724					25,884	50,793,608
13	Bomb photo M11A1 AC M23	28.00		816,942						816,942
14	Flare AC parachute bombing & recon w/time fuze M26	68.00		995,731			10,000		11,880	1,015,611
15	Flare AC recon M9	5.50		776,100						776,100
16	Signal air navig (drift sig) M25	2.80		823,600						823,600
17	Signal distress(smoke gren)M8(.41+)	1.31		15,712	67,000					82,712
18	Bomb cml incend gas 100#M47 amp (1.43+)	17.00		1,077,478						1,077,478
19	Bomb frag steh 23# M41	20.00		766,721			10,000		52,400	819,121
20	Bomb frag 23# parachute M40	28.60		1,363,145						1,363,145
21	Bomb cml 30# GS M46 (11.00+)	9.00		819,249						819,249
22	Bomb cml 30# WP M46 (16.33+)	9.00		-			20,000			20,000
23	Bomb cml 92 large 100# M47(36.50+)	12.00		300,132						300,132
24	Bomb demolition 100# M30	50.00		5,382,304		1,075,500	5,000	88,500	59,400	6,610,704
25	Bomb demolition 300# M31	64.00)		-			3,000	8,750		11,750
26	Bomb demolition 2# 250#	86.00)		5,374,994		1,207,200		86,400		6,668,594
27	Bomb demolition 500# M43	150.00		1,781,308		444,790	1,000	28,980	9,900	2,266,978
28	Bomb demolition 1000# M44	260.00		612,797		211,000		13,580		836,377
29	Bomb demolition 2000# M54	500.00		208,998		44,800		3,600		257,398
30	Bomb semi-AP 500#	250.00		767,989		164,910		12,420		945,319
31	Bomb semi-AP 1000#	400.00		264,526		57,360		4,320		326,006
32	Bomb AP 1600#	500.00		0						
33	Bomb depth (Navy type)	180.00		0						

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(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	ARTILLERY AMMUNITION									
1.	Shell fixed HE super chg 75mm G M48 CR	$ 11.97	14,922,620		317,376		20,000			15,259,996
2.	Shell fixed HE norm chg 75mm G M48 CR	11.51	19,539,109		280,960		80,000			19,900,069
3.	Shell fixed HE red chg 75mm G M48 CR	9.58	0				50,000			50,000
4.	Shell gas HS 75mm G M41 (2.52#)	8.46	0							0
5.	Shell smoke WP 75mm G M41 (1.81#)	8.46	0		29,556				47,600	77,156
6.	Shell gas HS 75mm How M64 (2.52#)	8.43	1,691,440							1,691,440
7.	Shell HE 75mm How M48 CR	12.83	10,918,796		1,616,461		750,000		428,400	13,713,657
8.	Shell smoke WP 75mm How M64 (1.82#)	11.98	1,415,051		81,900		150,000			1,646,951
9.	Shot AP 75mm Tank & Antitank M61 CR or Shot SAP 75mm M72	29.18	66,872,267				15,000			66,887,267
10.	Shell HE 105mm How M1 CR	29.38	33,656,300				130,000	18,000,000		51,786,300
11.	Shell gas HS 105mm How M60 (3.32#)	29.68	4,212,220					2,000,000		6,212,220
12.	Shell smoke WP 105mm How M60 (2.40#)	29.68	4,208,820				20,000	2,000,000		6,228,820
13.	Shell HE 155mm How (M41A1) M102 w/f	40.77	2,336,175		159,840		50,000	5,000,000		7,546,015
14.	Shell gas HS 155mm How M104 M41A1 w/fuse (5.22#)	28.56	300,740					700,000		1,000,740
15.	Shell smoke WP 155mm How M104 M41A1 w/fuse (7.78#)	28.56	298,140		17,760		10,000	700,000		1,006,140
16.	Charge prop reduced 155mm How M1 M14A1 (green bag)	5.00	1,222,190				10,000	3,000,000		4,232,190
17.	Charge prop normal 155mm How M2 (white bag)	7.90	1,480,200				30,000	2,400,000		3,910,200
18.	Shell HE 155mm How M107	31.45	12,518,898			480,000				12,998,898
19.	Shell gas HS 155mm How (5.22#)	28.56	577,760			48,000				625,760
20.	Shell smoke WP 155mm How (7.78#)	28.56	1,564,880							1,564,880
21.	Charge prop reduced 155mm How M3 (green bag)	7.90	7,822,400							7,822,400
22.	Charge prop normal 155mm How M4 (white bag)	7.90	7,824,329							7,824,329
23.	Shell HE 4.5" M65	47.00	1,542,240							1,542,240
24.	Shell gas HS 4.5" (5.00#)	47.00	0							0
25.	Shell smoke WP 4.5" (5.00#)	47.00	0							0
26.	Charge prop 4.5" base increment	12.00	1,425,600							1,425,600
27.	Shell HE 155mm Gun M1 M101 w/fuse	54.30	357,760				15,000			372,760
28.	Shell HE 155mm G M1917-18 M41A1 w/f	54.30	706,532		259,200					965,732
29.	Shell semi-AP 155mm G M1917-18	95.00	779,424							779,424
30.	Shell gas HS 155mm Field G M1917-18	29.14	80,460							80,460
31.	Shell smoke WP 155mm Field G M1917-18	29.14	80,460		28,800					109,260
32.	Shell gas HS 155mm G M1 M104 w/f (5.00#)	29.14	5,980							5,980
33.	Shell smoke WP 155mm G M1 M104 (7.78#)	29.14	6,960				5,000			11,960
34.	Charge prop 155mm Gun M1	26.37	370,700				20,000			390,700
35.	Charge prop 155mm Gun M1917-18	20.62	1,826,538							1,826,538
36.	Shot AP 3" Tank Gun	31.16	1,458,000							1,458,000
37.	Shell HE 3" Tank Gun	19.20	1,458,000							1,458,000
38.	Shell HE 8" How	102.00				197,760				197,760
39.	Charge Prop 8" How	27.97				189,800				189,800

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ORDNANCE EQUIPMENT

REQUIREMENTS FOR SPECIAL TROOP BASIS

U. S. Estimate of Needs of Foreign Nations - For Planning Purposes Only

THIS LIST INCLUDES CRITICAL ITEMS ONLY

Item No.	Item	Unit Cost	Army Ground Force	Army Air Force	Navy	Great Britain	Latin America	Russia	China	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	INFANTRY & ANTIAIRCRAFT AMMUNITION									
1	Cart AP cal..50 M 2 ground)									
2	" " " " AC)Unit)1000	75.00	4,784,977		566,808			83,000		5,354,782
3	Cart Ball cal.. 50 M2 ground)									
4	" " " " AC)Unit)1000	48.00	14,858,836		1,421,983	250,000	110,000	344,000		16,864,819
5	Cart tracer cal.. 50 M1 ground)									
6	" " " " AC)Unit)1000	68.00	3,468,755		227,579		30,000	43,000		3,766,334
7	Cart Ball cal.. 45 M1911 Unit 1000	26.00	1,247,001		68,869	50,482	14,000	55,000	89,191	1,474,543
8	Cart tracer cal.. 45 M1 Unit 1000	47.00	384,729					11,000		395,729
9	Cart AP cal..50 M1 ground)									
10	" " " " AC)Unit)1000	250.00	2,407,689		940,758	8,000	4,500	260,000		3,620,947
11	Cart tracer cal..50 M1 ground)									
12	" " " " AC)Unit)1000	225.00	685,618		684,008		3,000	40,000		1,412,626
13	Link metallic belt cal..50 M1 AC (Unit 1000)	6.00	672,579							672,579
14	Link metallic belt cal..50M2 (4))	13.00	2,900,671		288,672					3,189,343
15	AC (Unit 1000)									
16	Grenade hand frag MkII M10a1 w/fem.	1.32	3,803,050		1,062,773	2,000,000	100,000			6,965,823
17	Grenade hand gas irritant CN M7 (1.29+)	.95	0		22,400					22,400
18	Grenade hand gas irritant CN-DM M6 (1.29+)	.95	0							0
19	Cart signal ground (asstd) each	2.60	5,614,196		204,049					5,818,245
20	Light signal Very Mk11 green	.48								
21	" red	.41	10,338,201		176,723	705,000	10,000			11,229,924
22	" white	.41								
23	Shot fixed AP 57mm tank & anti-tank M51 CR	4.53	95,199,148		1,641,810	2,287,400	200,000	19,500,000		118,828,068
24	Shell fixed HE " M65 CR	3.66	70,255,560		1,111,972		200,000	13,000,000		84,567,532
25	Shell HE 60mm mortar M49A1A2 CR	4.98	19,861,376			1,760,000	1,000,000	11,000,000		33,321,376
26	Shell HE Lt 81mm mortar M43 CR	7.05	4,328,023		999,356	2,940,000	500,000	2,500,000		11,067,379
27	Shell HE Hv 81mm mortar M56 CR	9.60	1,734,160		260,270	1,085,000	100,000	750,000		3,425,430
28	Shell smoke WP " M57 (2.10+)CR	9.75	616,672			1,440,000		350,000		2,406,672
29	Mine antitank M1 CR	5.80	6,864,080							6,864,080
30	Shell HE 57mm antiaircraftM54CR	4.56	16,789,400		710,400				786,000	18,285,800
31	Shot AP " M59 CR	4.53	1,667,600						786,000	2,453,600
32	Shot AP 3" AA mobile M62 CR	51.16	0				25,000			25,000
33	Shell HE 3" AA mobile M42 CR	16.62	0		809,940		40,000			849,940
34	Shell HE 90mm AA M71 M58 CR	26.52	959,150		1,296,000	5,800,000	55,000	9,000,000	72,000	16,842,130
35	Shell AP 90mm AA CR	53.75	69,750					450,000		519,750
36	Shell HE 40mm AA	5.00	25,452,900			5,000,000		31,800,000	270,000	60,222,900
37	Shell AP 40mm AA	6.00	2,828,100					3,500,000		6,328,100
38	Shell HE 4.7" AA Gun	60.00	0							0

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Item No.	Critical Item	Unit Cost	Army Ground Force	Army Air Force	Navy	Great Britain	Latin America	Russia	China	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	AIR CORPS REQUIREMENTS									
	SMALL ARMS AND CANNON									
1	Gun machine cal.,30 M2 AC	$ 700		56,152	54,760	82,250	200	3,300	289	196,951
2	Gun machine cal.,50 M2 AC	1,200		147,286	-	219,750	600	50,000		417,636
3	Gun 20mm AC	4,000		24,542	52,227	66,000	60			142,829
4	Gun 37mm AC	5,000		7,109		3,000				10,109
5	Pistol pyrotechnic M2 AC	30		56,376					40	56,416
6	Gun MG, Cal. 50 Brg. Basic Navy				168,294					168,294

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QUARTERMASTER - MOTOR TRANSPORTATION

REQUIREMENTS FOR SPECIAL TROOP BASIS

U. S. Estimate of Needs of Foreign Nations - For Planning Purposes Only

THIS LIST INCLUDES CRITICAL ITEMS ONLY

Item No.	Critical Item	Unit Cost	Army Ground Force	Army Air Force	Navy	Great Britain	Latin America	Russia	China	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1	Ambulance	1,300	21,329				200			21,529
2	Cars, Passenger	700	10,590			500	1,200			12,290
3	Motorcycles	450	73,293			6,801	1,900			80,774
4	Trucks, ¼-ton	875	93,588			1,220	2,000			96,808
5	Trucks, ½-ton	1,050	216,218			1,400	1,000			218,628
6	Trucks, 1½-ton	1,450	116,232			28,711	2,000			147,003
7	Trucks, 2½-ton	2,500	266,380			30,468	1,500			298,348
8	Trucks, 4-4-ton	5,500	23,463			198	800			24,461
9	Trucks, 6-ton	8,000	11,171			125	400			11,694
10	Semi-trailers	1,450	8,000							8,000
11	Trailers	350	126,483			1,352	2,000			130,835

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QUARTERMASTER - CLOTHING AND EQUIPAGE

REQUIREMENTS FOR SPECIAL TROOP BASIS

U. S. Estimate of Needs of Foreign Nations - For Planning Purposes Only

THIS LIST INCLUDES CRITICAL ITEMS ONLY

Item No.	Critical Items	Unit Cost	Army Ground Force	Army Air Force	Navy	Great Britain	Latin America	Russia	China	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	CLOTH:									
	WOOLENS:									
1	OVERCOATING, Melton, 32 oz. yds.	$ 2.52	22,190,104							22,190,104
2	FLANNEL LINING, 12 oz. yds.	1.60	19,850,050							19,850,050
3	FLANNEL SHIRTING, 10.5 oz. yds.	1.83	42,780,787							42,780,787
4	ELASTICS, Lt. Shade, 18 oz. yds.	3.07	1,670,056							1,670,056
5	SERGE, light shade, 18 oz. yds.	2.98	37,700,700							37,700,700
6	SERGE, dark shade, 18 oz. yds.	2.98	15,934,921							15,934,921
7	SUITING, woolen, 20 oz. yds.	2.39	6,899,548							6,899,548
8	LINING, knitted wool, yds.	2.62	431,339							431,339
9	COVERT, blue	2.34	946,094							946,094
	COTTONS:									
10	DUCK, OD, Water Repel., yds.	.47	12,548,237							12,548,237
11	KHAKI, 8.2 oz. yds.	.55	94,719,280							94,719,280
12	HERRINGBONE TWILL, yds.	.35	97,691,145							97,691,145
13	DUCK, KHAKI, 17.5 oz. yds.	.33	1,843,638							1,843,638
14	FIRE RESISTANT, Poplin, yds.	.54	38,597,580							38,597,580
15	KHAKI, 8.2 oz. Zelan Treated	.96	12,974,452							12,974,452
16	TWILL, rayon, OD, 8.5 oz. yds.	1.01	375,291							375,291
17	HERRINGBONE TWILL, Water Repel.yds	.40	8,729,549							8,729,549
	SUB-TOTAL — CLOTH									
	MAIN FINISHES:									
18	CLOTH, cotton, OD, yds.	.295	19,707,017							19,707,017
19	DRILL, cotton, unbleached, yds.	.232	73,044,727							73,044,727
20	CLOTH, lining, sateen, yds.	.182	15,230,780							15,230,780
21	LINING, Uniform, cotton, twill,yds	.314	11,408,231							11,408,231
22	DUCK, Canvas, cotton, yds.	.174	10,537,965							10,537,965
23	FELT, OD, 18 to 20 oz. 54", yds.	1.53	1,054,326							1,054,326
24	DUCK, 12/c, 48 oz. yds.	1.00	5,653,591							5,653,591
	SUB-TOTAL — MAIN FINISHES									

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QUARTERMASTER - CLOTHING AND EQUIPAGE

REQUIREMENTS FOR SPECIAL TROOP BASIS

U. S. ESTIMATE OF NEEDS OF FOREIGN NATIONS, PLANNING PURPOSES ONLY.

THIS LIST INCLUDES CRITICAL ITEMS ONLY

Item No.	Critical Item	Unit Cost	Army Ground Force	Army Air Force	Navy	Great Britain	Latin America	Russia	China	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	MINOR FINISHES:									
25	COTTON UNIFORM:									
	a. Breeches, EM, service	.156	5,487,934							5,487,934
	b. Cape, field	.007	15,263,242							15,263,242
	c. Hats, field	-do-	st							0
	d. Neckties	.001	19,865,162							19,865,162
	e. Shirts, EM	.060	30,588,409							30,588,409
	f. Trousers, EM, service	.118	20,775,154							20,775,154
26	HERRINGBONE TWILL CLOTHING:									
	a. Caps	-do-	st							0
	b. Hats	-do-								0
	c. Jackets	-do-	st							0
	d. Suits, one-piece	.155	6,246,456							6,246,456
	e. Trousers	-do-								0
27	WOOLEN UNIFORM:									
	a. Breeches, EM, service	.236	4,414,210							4,414,210
	b. Cape, field	.024	10,515,766							10,515,766
	c. Cape, winter	.423	5,613,621							5,613,621
	d. Coats, mackinaw	.127	3,947,901							3,947,901
	e. Coats, EM, service	.151	7,991,059							7,991,059
	f. Jackets, field	.183	15,337,255							15,337,255
	g. Overcoat, EM, roll collar	.149	7,703,653							7,703,653
	h. Shirts, EM	.025	20,633,502							20,633,502
	i. Trousers, EM, service	.436	23,084,681							23,084,681
28	WOMENS CLOTHING:									
	a. Caps, field	.0675	114,133							114,133
	b. Cape	8.33	122,074							122,074
	c. Coat, Norfolk	2.40	114,133							114,133
	d. Overcoat	7.23	94,284							94,284
	e. Skirt	.0775	114,133							114,133
29	PARACHUTISTS' CLOTHING:									
	a. Suit	-do-	st							0
30	ARMORED FORCE CLOTHING:									
	a. Jacket, Combat	1.31	2,130,067							2,130,067
	b. Trousers, combat	.44	2,130,067							2,130,067
	c. Helmet, combat	.04	2,130,067							2,130,067

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SIGNAL CORPS EQUIPMENT (Air Corps)

REQUIREMENTS FOR SPECIAL TROOP BASIS

U. S. ESTIMATE OF NEEDS OF FOREIGN NATIONS. PLANNING PURPOSES ONLY.

THIS LIST INCLUDES CRITICAL ITEMS ONLY

Item No.	Critical Aircraft Items	Unit Cost	Army Ground Force	Army Air Force	Navy	Great Britain	Latin America	Russia	China	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1.	British Type IFF (SCR-535)	$ 1,000.		32,598						32,598
2.	Contactor BC-608	100.		5,556						5,556
3.	Filter Equipment RC-32	50.		64,100						64,100
4.	Frequency Meter Set SCR-211	300.		10,775					35	10,810
5.	Interphone Equipment RC-15-A	430.		3,848						3,848
6.	Interphone Equipment RC-27	105.		30,290						30,290
7.	Interphone Equipment RC-36-35-51	400.		18,794					35	18,829
8.	Marker Beacon Receiving Equipment RC-39	100.		3,644					35	3,679
9.	Marker Beacon Receiving Equipment RC-43	100.		7,295						7,295
10.	Microphone T-30-20	18.		236,458					35	236,496
11.	Microphone Amplifying Equipment RC-19	88.		3,848						3,848
12.	Radio Compass SCR-246	1,000.		3,847					300	4,148
13.	Radio Compass SCR-263	1,000.		6,500						6,500
14.	Radio Compass SCR-269-276-280	2,000.		1,066					35	1,101
15.	Radio Set SCR-183	1,200.		36,730		6,000	300		35	43,665
16.	Radio Set SCR-238	3,000.		3,804			200			4,004
17.	Radio Set SCR-260	3,000.		1,950						1,950
18.	Radio Set SCR-274-240	3,000.		4,257		9,750		6,000		20,007
19.	Radio Set SCR-283	1,200.		24,795						24,795
20.	Radio Set SCR-287-187	4,000.		12,292		9,750	130		35	22,207
21.	Radio Set SCR-297	5,000.		10,373						10,373
22.	Radio Set SCR-515	1,750.		76,907						76,907
23.	Radio Set SCR-517	6,000.		10,373						10,373
24.	Radio Set SCR-518	5,000.		2,617						2,617
25.	Radio Set SCR-519	10,000.		10,373						10,373
26.	Radio Set SCR-520	16,000.		16,885						16,885
27.	Radio Set SCR-521	2,250.		2,617						2,617
28.	Radio Set SCR-522	3,000.		5,556						5,556
29.	Radio Set SCR-540	13,000.		17,050						17,050
30.	Radio Set SCR-542	3,000.		17,550						17,550

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SIGNAL CORPS EQUIPMENT (Ground Forces)

REQUIREMENTS FOR SPECIAL TROOP BASIS

U. S. ESTIMATE OF NEEDS OF FOREIGN NATIONS. PLANNING PURPOSES ONLY.

THIS LIST INCLUDES CRITICAL ITEMS ONLY

Item No.	Critical Items (Ground Forces)	Unit Cost	Army Ground Force	Army Air Force	Navy	Great Britain	Latin America	Russia	China	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1.	Charging Set SCR-169	$ 275.	4,023							4,023
2.	Converter M-209	175.	57,737							57,737
3.	Fixed, VHF Ground AC Communication System	300,000.	0							0
4.	Flash Ranging Set SR-4	1,650.	70							70
5.	Frequency Meter Set SCR-211-A	300.	40,018							40,018
6.	GCI Plane Position Indicator (SCR-527)	30,000.	1,090							1,090
7.	Gun Laying Equip. w/early warning (SCR-545)	55,000.	1,757							1,757
8.	Gun Laying Equip. Shore to Ship-Medium (SCR-296)	35,000.	0							0
9.	Gun Laying Equip. Shore to Ship-Long Range (SCR-296)	60,000.	92							92
10.	Instrument Blind Landing Equipment SCR-241	40,000.	1,532							1,532
11.	Interphone Equipment RC-38-44-48	250.	16,915				500			17,415
12.	Mobile VHF Ground AC Communication Systems	350,000.	93							93
13.	Panel BD-97e									
14.	Radio Receiver RC-342	700.	7,198							7,198
15.	Radio Set SCR-177-B	4,800.	1,426				50			1,476
16.	Radio Set SCR-178	825.	3,494				20			3,514
17.	Radio Set SCR-179	850.	157				20			177
18.	Radio Set SCR-188	4,400.	9,198				50			9,248
19.	Radio Set SCR-193	4,200.	24,277			6,505	90			30,872
20.	Radio Set SCR-194	300.	17,526				200			17,726
21.	Radio Set SCR-195	300.	21,682				400	1,000		23,082
22.	Radio Set SCR-197	20,000.	1,701							1,701
23.	Radio Set SCR-203	750.	289				400			689
24.	Radio Set SCR-243	325.	298							298
25.	Radio Set SCR-244	260.	915							915
26.	Radio Set SCR-245	3,000.	35,971			12,004	90			48,065
27.	Radio Set SCR-255	3,000.	295							295
28.	Radio Set SCR-268	35,000.	3,010					500		3,510
29.	Radio Set SCR-270	65,000.	1,763							1,763
30.	Radio Set SCR-277	15,000.	641							641
31.	Radio Set SCR-508	2,500.	11,467							11,467
32.	Radio Set SCR-509	2,000.	11,857							11,857
33.	Radio Set SCR-510	2,000.	21,786							21,786
34.	Radio Set SCR-528	2,000.	31,570							31,570
35.	Radio Set SCR-532	10,000.	930							930
36.	Radio Set SCR-533	25,000.	1,328							1,328
37.	Radio Set SCR-536	200.	18,114							18,114
38.	Radio Set SCR-538	800.	26,671				770			27,441

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SIGNAL CORPS EQUIPMENT (Ground Forces)

REQUIREMENTS FOR SPECIAL TROOP BASIS

U. S. ESTIMATE OF NEEDS OF FOREIGN NATIONS. PLANNING PURPOSES ONLY.

THIS LIST INCLUDES CRITICAL ITEMS ONLY

Item No.	Critical Items (Ground Forces)	Unit Cost	Army Ground Force	Army Air Force	Navy	Great Britain	Latin America	Russia	China	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
39.	Reel Equipment TM-11	49.	41,653							41,653
40.	Remote Control Equipment RC-466	35.	6,867							6,867
41.	Searchlight Control Equipment (SCR-521)	9,600.	8,613							8,613
42.	Signal Lamp Equipment TM-34	400.	2,265							2,265
43.	Sound Ranging Set TM-3	11,000.	82							82
44.	Switchboard BD-71	175.	19,842				600			20,494
45.	Switchboard BD-72	160.	11,712				200			11,912
46.	Switchboard BD-79	2,300.	142							142
47.	Switchboard TM-96						40			40
48.	Telegraph Printer Set SB-47	840.	5,986							5,986
49.	Telephone EE-8	40.	366,752				1,000			366,752
50.	Telephone Central Office Set SB-1	25,000.	158							158
51.	Telephone Central Office Set SB-2	8,000.	120							120
52.	Telephone Central Office Set SB-4	1,200.	3,718							3,718
53.	Test Set I-56	180.	5,908							5,908
54.	Theodolite M2-47	500.	109							109
55.	Time Interval Apparatus EA-35	300.	0							0
56.	Transmitter Tuning Unit TM-25	60.	27,797							27,797
57.	Wire W-110 (miles)	45.	802,453				5,000	150,000		957,453
58.	Wire W-130	75.	155,453							155,453

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AIR CORPS SUPPLIES (For Army and Services Other Than Air Corps)

REQUIREMENTS FOR SPECIAL TROOP UNITS

U. S. ESTIMATE OF NEEDS OF FOREIGN NATIONS. PLANNING PURPOSES ONLY.

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Item No.	Item	Unit Cost	Army Ground Force	Army Air Force	Navy	Great Britain	Latin America	Russia	China	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	PARACHUTE BATTALIONS BASED ON 48 BATTALIONS									
	Bag, Flyers Kit A-3	3	34,304							34,304
	Containers, Cargo A-4	50	6,153							6,153
	Containers, Squadron A-8	55	7,370							7,370
	Helmet, Summer A-6	2	28,276							28,276
	Parachutes, Cargo A Squadron	128	13,041							13,041
	Parachutes, seat type S-1	110	12,600							12,600
	Vests, life preserver S-5	15	28,276							28,276
	Parachutes w/breat pack T4	276	28,276							28,276
	Misc. initial equipment (packing tables, sewing machines, supplies, etc.)	45,000	69							69
	ARMORED DIVISIONS BASED ON 41 DIVISIONS									
	Gloves, A-10	2	523,463							523,463
	Helmets A-6	2	132,464							132,464

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MEDICAL EQUIPMENT
REQUIREMENTS FOR SPECIAL TROOP BASIS

U. S. Estimate of Needs of Foreign Nations - For Planning Purposes Only

THIS LIST INCLUDES SURPLUS ITEMS

Item No.	Item	Unit Cost	Army Ground Forces	Army Air Force	Navy	Great Britain	Latin America	Russia	China	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1.	Packet, First-Aid	.22	6,958,643		12,000		390,000			7,370,643
2.	Surgical Instruments*									
3.	Splint, Cabot	.56	19,322							19,322
4.	Splint, Thomas, Arm, Hinged	1.20	116,317							116,317
5.	Splint, Army, Leg, Half-Ring	1.80	116,392							116,392
6.	Splint, Wrist, Cook-Oh	.27	69,941							69,941
7.	Cassette, Changer, Stereoscopic, Upright, Magnetically Controlled	860.00	780							780
8.	Machine, Radiographic and Fluoroscopic	5,000.00	1,089							1,089
9.	Table, Urological	1,100.00	428							428
10.	Steriliser, Hospital	1,875.00	1,089							1,089
11.	Steriliser, Hospital, Steriliser Dressing, Pressure Type	860.00	317							317
12.	Steriliser, Hospital, Steriliser Utensil, Nonpressure Type	270.30	7,162							7,162
13.	X-Ray Field Unit, Chest, Film, X-Ray	85.00	2,067							2,067
14.	X-Ray Field Unit, Dryer, and Loading Bin Comb	65.00	1,080							1,080
15.	X-Ray Field Unit, Generator, Gasoline, Electrical	800.00	2,009							2,009
16.	X-Ray Field Unit, Grid, Portable	325.00	1,857							1,857
17.	X-Ray Field Unit, Machine, X-Ray Mobile, Complete	1,310.00	2,299							2,299
18.	Chest, MD., No. X-1	445.00	2,066							2,066
19.	X-Ray Field Unit, Processing Unit, For DarkRoom	700.00	1,684							1,684
20.	X-Ray Field Unit, Table, Unit	840.00	1,983							1,983
21.	X-Ray Field Unit, Tent, Dark Room	575.00	1,465							1,465
22.	X-Ray Field Unit, Cable Chest	432.75	225							225
23.	Kit Component, Cantle Ring Strap	.26	361,852							361,852
24.	Kit Component, Insert, Type I	.26	158,086							158,086
25.	Kit Component, Insert, Type II	.25	25,769							25,769
26.	Kit Component, Litter Strap	.31	542,589							542,589
27.	Kit Component, Pouch	.94	380,497							380,497
28.	Kit Component, Suspension	.99	147,850							147,850
29.	Chest, Field, Plain	9.69	26,924							26,924
30.	Chest, Field, Modified	14.50	8,977							8,977
31.	Chest, Pack, Empty	18.30	1,557							1,557

* The different types of surgical instrument Approved

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CHEMICAL WARFARE SERVICE

RECOMMENDATIONS FOR OFFICIAL TROOP TESTS

U. S. ESTIMATE OF WORLD OF POSSIBLE NATIONS. PLANNING PURPOSES ONLY.

THIS LIST INCLUDES CHEMICAL ITEMS ONLY

Item No.	Item	Unit Cost	Army Ground Force	Army Air Force	Navy	Great Britain	Latin America	Russia	China	Total *
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1.	Mask, Gas, Service	6.50	10,480,757				200,000			10,680,757
2.	Mask, Gas, Diaphragm	10.50	3,756,963							3,756,963
3.	Mask, Gas, Optical	11.00	0							0
4.	Canister, Service	1.47	7,948,898				200,000			8,148,898
5.	Canister, Diaphragm	1.47	2,930,801							2,930,801
6.	Canister, Optical	4.00	0							0
7.	Tanks, Airplane, Smoke, M-10	160.00	0				500			500
8.	Tanks, Airplane, Smoke, M-20	400.00	1,920							1,920
9.	Tanks, Airplane, Smoke, M-31	575.00	1,920							1,920
10.	Apparatus, Decon., Power Driven	3,500.00	3,102							3,102
11.	Agent, Decon., Bleach (tons)	200.00	25,004							25,004
12.	Agent, Decon., Bleach, High Test (tons)	800.00	17,976							17,976
13.	Agent, Decon., Non-Corrosive (gal)	3.50	6,455,367							6,455,367
14.	HD (tons)	400.00	28,219							28,219
15.	TH (tons	160.00	0							0
16.	HN (tons	800.00	136,722				100			136,822
17.	CG (tons	250.00	37,058			1,500				38,558
18.	M-1 (tons)	2,000.00	0							0
19.	CNS (tons)	1,500.00	0				50			50
20.	Incendiary Bombs, Br. 4 lb.	2.00	143,874,353			41,825,000		3,150,000		188,549,353
21.	Incendiary Bombs, Br. 40 lb.	20.00	4,080,700			1,702,500		90,800	52,400	6,015,600

* These resources are shown in accordance with all pending but finalized. None has yet been.

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REQUIREMENTS FOR PLANNING

REQUIREMENTS FOR SPECIAL TROOP BASIS

U. S. Estimate of Needs of Foreign Nations - For Planning Purposes Only

TEN LIST INCLUDING CRITICAL ITEMS ONLY

Item No.	Item	Unit Cost	Army Ground Forces	Army Air Forces	Navy	Great Britain	Latin America	Russia	China	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	AIRCRAFT									
1	Heavy Bomber (B-29 type)			8,266						8,266
2	Heavy Bomber, 4-engine (B-17 type)			5,986		14,000				19,986
3	Medium Bomber 2-engine (B-26 type)			1,449		2,750	20	3,000	33	7,252
4	Light Bomber, 2-engine (A-20 type)			0					33	33
5	Light Bomber, 1-engine (A-24 type)			1,724		2,750	39			4,513
6	Pursuit, 2-engine (P-38 type)			3,498		3,000	69			6,567
7	Pursuit, 1-engine (P-51 type)			2,118		3,000	78	3,000		8,196
8	Observation (O-63 type)			2,519			116			2,635
9	Observation (O-49 type)			445			20			465
10	Transport, 4-engine (DC-4 type)			171						171
11	Transport, 2-engine (DC-3 type)			2,304			39		33	2,376
12	Adv. Trng., 2-engine			4,366			119			4,485
13	Adv. Tri., 1-engine			99			119			218
14	Basic Trng.			5,511			366			5,567
15	Primary Trng.			8,127			436		70	8,633

Note: The above computation for the Army Air Forces is the initial requirement, including the 20% impact reserve, plus 1 year's replacement at an attrition rate of 20% per month applied to all airplanes except those on Operational Training Units, to which a 3% attrition rate is applied. It is less airplanes already on order. (See AFH 50 for airplanes on order).

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Jt Bd Rpt #308(725) Bermuda /14-9/
W Indies Coord Loc Def-Leased Bases

145.81-24
A4E. 1941

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Director
Research Studies Institute
Attn: Archives Branch
Maxwell AFB, Alabama

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Jt Bd Rpt #308(725) Bermuda /14-a/
W Indies Coord Loc Def-Leased Bases

5-1677-53 R-35

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December 16, 1941

Received from Major R. C. Lewis, the following secret documents:

Disposition Form 12/15/41 4351-100

J.B.No. 308 (Serial 725) - Coordination of Local Defense Measures in Bermuda and the West Indian Islands where United States Bases are being established.

w/1 Incl.

MAJOR C. M. TAYLOR

AIR WAR PLANS

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THE JOINT BOARD
JOINT PLANNING COMMITTEE
Washington

J.B. No. 308
(Serial 725)

September 12, 1941.

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From: The Joint Planning Committee.

To: The Joint Board.

Subject: Coordination of Local Defense Measures in Bermuda and the West Indian Islands where United States Bases are being established.

Enclosure: (A) Subject Agreement and Joint Letter of Transmittal.

The subject Agreement, which was prepared as a result of collaboration between the War Plans Divisions of the War and Navy Departments and the British Joint Staff Mission in Washington, in accordance with a directive contained in J.B. No. 308 (Serial 706) July 3, 1941, is transmitted herewith, with the recommendation that it be approved.

It is important that action be taken by the President as indicated in paragraph 2 of the Letter of Transmittal, in order that defense plans may be prepared at each island or territory concerned.

(Sgd) L. T. Gerow
L. T. GEROW,
Brigadier General, U. S. Army.

(Sgd) R. K. Turner
R. K. TURNER,
Rear Admiral, U. S. Navy.

Approved

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J.B. No. 308
(Serial 725)

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L.B.(J)(41)14

UNITED STATES LEASED BASES - LOCAL DEFENSE

UNITED STATES AND BRITISH STAFF CONVERSATIONS.

JOINT LETTER OF TRANSMITTAL

Washington, D.C.
August 30, 1941.

To: The Chief of Naval Operations, United States Navy.
The Chief of Staff, United States Army.
The Chiefs of Staff of the United Kingdom.

Sirs:

1. Representatives of the United States Joint Planning Committee and the British Joint Staff Mission in Washington met at Washington on July 9, 1941, to conduct staff conversations on the principles of command and local defense of the United States Leased Bases and the British Territories in which they lie, excluding Newfoundland.

2. The Conference recognizes that the Agreement attached is made subject to the approval of the United States and British Chiefs of Staff and subsequent confirmation by the President of the United States and the United Kingdom Government.

3. The Agreement is based on the understanding that there shall be at all times mutual co-operation in local defense, and that on instructions from the Governments of both the Associated Powers, or when the Associated Powers become mutually associated in a war against a common enemy there shall be unity of command of the United States and British local defense forces.

4. It may be found necessary, in the light of experience, to establish a Joint Advisory Board at some suitable place to be agreed upon by the Associated Powers, to which Local Combined Defense Committees and Local Joint Military Defense Sub-Committees can refer points of difference for discussion.

5. In course of time it may be found necessary to coordinate the tactical operations of the United States Army Air Forces and the Royal Air Force engaged in local defense at any or all of the Territories concerned by the exercise of unity of command over these Air Forces by an Air Officer of either of the Associated Powers.

6. The discussions did not include a consideration of the use by a Third Power of the facilities of either of the

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Associated Powers, since this matter was considered to be outside the scope of the Conference.

(Signed) Harry J. Malony
HARRY J. MALONY,
Brigadier General, U.S. Army.

(Signed) F. P. Thomas
F. P. THOMAS,
Commander, U. S. Navy.

(Signed) V. H. Danckwerts,
Rear Admiral.
for
C.J.C. LITTLE,
Admiral.

(Signed) H. C. B. Wemyss
H. C. B. WEMYSS,
Lieut.-General.

(Signed) A. T. Harris
A. T. HARRIS,
Air Marshal.

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J.B. No. 308
(Serial 725)

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L.B.(J)(41)14
SHORT TITLE ABC-3

UNITED STATES LEASED BASES

AGREEMENT BETWEEN THE UNITED STATES AND THE

UNITED KINGDOM REGARDING LOCAL DEFENSE

REVISED August 30, 1941
By The Joint Board
November 3, 1941

GENERAL

1. The terms of this Agreement shall apply to the following Territories: Great Exuma, Bermuda, Jamaica, Antigua, St. Lucia, Trinidad and British Guiana.

2. The Leased Bases are of vital importance to the United States in the general defense of its homeland and of the Western Hemisphere. This wider defense plan is therefore of necessity, primarily the concern of the United States. The Territories in which the Leased Bases lie are also of capital importance to the British Empire in its own Empire defense scheme, being situated on trade routes which are vital to the British Empire's existence and being an essential element in their defense. These Territories also contain valuable materials necessary to the British war effort. The United States and the United Kingdom are therefore mutually interested and concerned in the defense of the Leased Bases and the Territories in which they lie.

3. This Agreement is limited to the purely local defense of the Leased Bases and the Territories in which they lie.

4. Collaboration of the Local Defense Forces of both the Associated Powers and the Civil Administrations shall be by mutual co-operation. Unity of command of the Local Defense Forces of both Powers shall be established under the circumstances described in Article 17 of this Agreement.

LOCAL COMBINED DEFENSE COMMITTEE

5. A Local Combined Defense Committee shall be formed at each of the Territories concerned to co-ordinate the Military and Civil Defense Plans into a Local Combined Defense Plan (Scheme), which shall be submitted to the higher United States and British authorities shown on the diagram in Annex I for approval.

6. The Governor of the Terriroty shall be the convening authority and preside over the Local Combined Defense Committee. He shall convene the Committee when he thinks necessary or at the request of any of the following:-

a. Either of the United States or British High Commands directly concerned;
b. The Senior United States or British Commanders of any of the Local Defense Forces.

7. The Local Combined Defense Committee, besides the Governor, shall include:-

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a. The Senior Officers of Local United States Army and Navy defense forces.

b. The Senior Officers of the Local British Navy, Army and Royal Air Force defense forces.

c. Such other local military and civil authorities as may be found necessary to serve on the Committee from time to time in an advisory capacity.

LOCAL JOINT MILITARY DEFENSE SUB-COMMITTEE

8. A Local Joint Military Defense Sub-Committee shall be formed at each of the Territories concerned and it shall be responsible for the preparation and co-ordination of the Local Defense Plans of all the combatant Services with a view to their embodiment in the Local Combined Defense Plan (Scheme).

9. The Presiding Officer of the Local Joint Military Defense Sub-Committee shall be the officer designated for the appointment as Commander of the Combined Local Defense Forces when unity of command is brought into force, and the deliberations of the Committee shall be carried out in a spirit of mutual co-operation.

10. The Sub-Committee shall include in the Local Defense Plans of the combatant Services, plans inter alia for the following:-

Manning and operation of coast defenses.
Manning and operation of anti-aircraft and aerodrome defenses.
Manning and operation of under-water defenses.
Air operations.
Mine-sweeping.
Entry and departure of military aircraft, warships and auxiliary war vessels of the Associated Powers.
Establishment of inshore and offshore naval patrols.
Machinery for affording facilities of one Power to the armed forces of the other.
Inter-change of operational intelligence affecting the defenses of the Base and Territory.
Routing and protection of shipping while in local waters.

11. In order to facilitate the compilation of the Local Combined Defense Plan (Scheme), Governments and representatives of the Associated Powers will exchange full and frank information of the forces, armaments and defense devices allocated to the Bases and Territories for their defense, together with details concerning their exact location and operation. This information will be passed to the appropriate Local Joint Military Defense Sub-Committee which shall make recommendations to meet any deficiencies and to prevent overlapping.

12. The forces, armaments and defense devices stationed or erected at the leased areas, sites and locations acquired or that may be acquired under the provisions of Article XXVII of the Agreement for the Use and Operation of Certain Bases in British Possessions, (Signed March 27, 1941),

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shall be decided by the United States Government and at each territory outside of the leased areas, sites and locations by the United Kingdom Government. Each government shall be free to allocate such forces, armaments and defense devices to the defense as it may desire, but there shall be consultation in order to avoid duplication or deficiency.

CHAIN OF COMMAND

13. Matters on which the Local Combined Defense Committees or the Local Joint Military Defense Sub-Committees are unable to agree shall be referred to the next respective higher authority shown in the diagram of the Chain of Command in Annex I. These higher authorities shall endeavor to reach agreement, but if this is not possible they, in turn, shall refer the matter in dispute to the next higher authority and so on.

THE GOVERNOR

14. The Governor of a British colony is the single and supreme authority responsible to and representative of His Majesty the King. Although bearing the title of Captain-General or Commander-in-Chief, he is not, except on special appointments from His Majesty, invested with the command of His Majesty's Forces in the colonies. He is not, therefore, entitled to take the immediate direction of any military operations.

15. In matters concerning the defense of a Territory, the Governor shall be the convening and presiding authority of the Local Combined Defense Committee and shall represent, as head of the civil administration, the views of the local Government. Purely military aspects of defense will be the responsibility of the Local Joint Military Defense Sub-Committee.

16. The Governor, as representing British sovereignty, is vitally interested in the maintenance of the integrity of the Territory and its security against aggression. When, therefore, in his opinion, the Territory is threatened, he will seek the advice of the Senior Military Commanders on defense measures and will have the right, subject to confirmation of the Governments concerned if time permits and otherwise by agreement with the Senior Military Commanders, to declare a state of emergency and to issue orders for putting into force such civil defense measures as he may consider appropriate to the situation. If these authorities are unable to agree, the question at issue shall be immediately referred by the quickest method to the responsible Governments for decision.

UNITY OF MILITARY COMMAND

17. Unity of Command shall be put into effect in the following circumstances:-

a. On instructions from the Governments of both the Associated Powers. Such instructions shall be sought by the respective local authorities by the quickest possible method in the event of an attack on a territory developing or when the Governor and the Senior Military Commanders agree that an attack is threatened.

b. On the Associated Powers becoming mutually associated in a war against a common enemy.

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18. Unity of command in the defense of a Territory shall vest in the commander of Combined Local Defense Forces the responsibility and authority to co-ordinate the operations of the participating forces of all the combatant Services by the organization of task forces, the assignment of missions, the designation of objectives and the exercise of such co-ordinating control as he deems necessary to insure the success of the defense. Unity of command does not authorize the commander exercising it to control the administration and discipline of the forces of the combatant Services to which he does not belong, nor to issue any instructions to such forces beyond those necessary for effective co-ordination.

THE COMMANDER OF THE COMBINED LOCAL DEFENSE FORCES.

19. On one of the circumstances as set out in Article 17 arising, a commander of the Combined Local Defense Forces, who shall be designated beforehand, shall assume unity of command of the Local Military Defense Forces, and the Commanders of the Local Defense Forces of all the combatant Services shall be responsible to him for the execution of the Local Defense Plans.

20. The nationality of the Officer to assume command of the Combined Local Defense Forces shall be determined by the general considerations of the strengths of the forces involved in the defense of the Territory, combined with the tactical or strategic importance of the locality to each of the Associated Powers respectively.

21. Initially the commander of the Combined Local Defense Forces shall be an officer of the United States armed forces at Great Exuma, Bermuda, Jamaica, Antigua, St. Lucia, Trinidad and British Guiana, but the situation at any or all of the Territories named shall be reviewed at any time at the request of either of the Associated Powers.

CO-ORDINATION OF OPERATIONS OF NAVAL LOCAL DEFENSE FORCES

22. When the commander of the Combined Local Defense Forces assumes unity of command, the co-ordination and direction of operations of the Naval Local Defense Forces shall be exercised by that Naval officer commanding Naval Local Defense Forces of either of the Associated Powers, who is senior in rank, or, if of equal rank, of time in grade.

23. Initially it shall be arranged that the naval officer exercising command at Great Exuma, Bermuda, Antigua, St. Lucia, and British Guiana, shall be a United States Officer, and the naval officer exercising command at Jamaica and Trinidad shall be a British Officer, but the situation at any or all of the Territories named shall be reviewed at any time at the request of either of the Associated Powers.

OPERATIONAL COMMAND OF AIR FORCES ENGAGED IN LOCAL DEFENSE

24. When the Commander of the Combined Local Defense Forces assumes unity of command, execution of tasks entrusted by him to United States Army Air Forces and the Royal Air Force, engaged in local defense, shall be carried out by the Senior officers of each of the Air Forces engaged. United States Naval

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aviation forces will operate under United States naval command and will remain an integral part of United States Naval task forces.

CIVIL DISTURBANCE AND INTERNAL SECURITY

25. It is the responsibility of the British authorities to maintain civil order in the Territories outside the leased areas, sites and locations.

26. In the event of civil disturbance and in the maintenance of internal security, the following principles shall be observed:-

a. Armed Forces shall only be employed when the civil police are unable to preserve order.

b. The armed forces of the United States shall, in no circumstances, be employed in aid of a civil power outside the Leased Areas unless:-

(1) The United States Government has acceded to an urgent request of the Governor of the Territory through the British Ambassador at Washington.

(2) The Governor and the Local United States Senior Military Commanders agree that immediate action is necessary and there is insufficient time to refer to Washington.

(Signed) Harry J. Malony
HARRY J. MALONY,
Brigadier General, U. S. Army

(Signed) F. G. Beaumont-Nesbitt
F. G. BEAUMONT-NESBITT,
Major-General

(Signed) S. H. Sherrill
S. H. SHERRILL,
Lieutenant Colonel, U.S. Army

(Signed) G. D. Belben
G. D. BELBEN,
Captain, R.N.

(Signed) H. A. Craig
H. A. CRAIG,
Lieutenant Colonel, U.S. Army

(Signed) Maurice Banks
MAURICE BANKS,
Wing Commander

(Signed) F. P. Thomas
F. P. THOMAS,
Commander, U.S. Navy.

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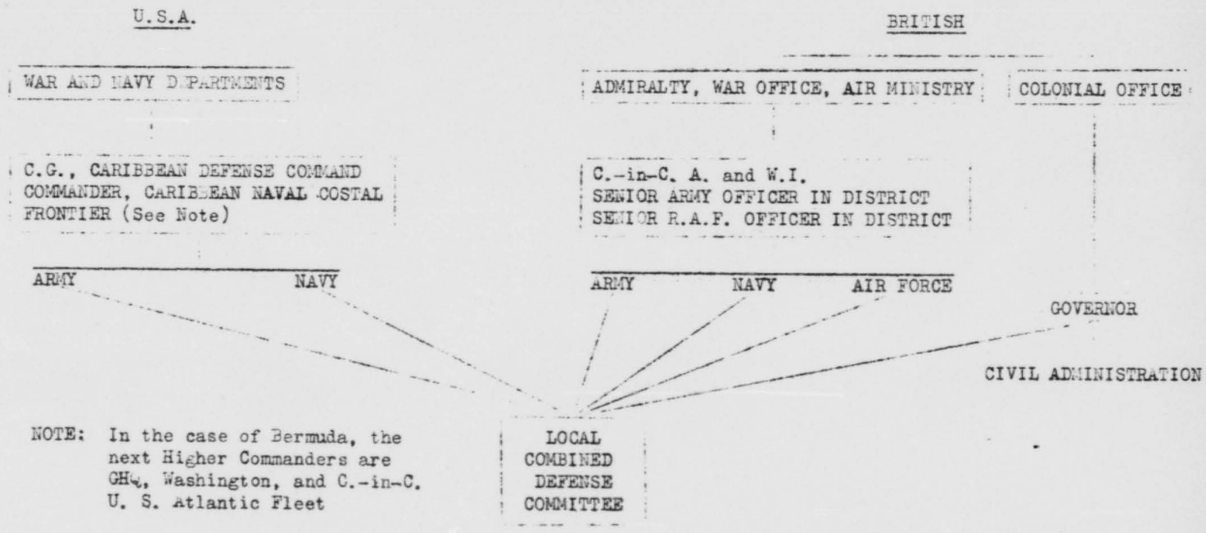
ANNEX I.

CHAIN OF COMMAND



NOTE: In the case of Bermuda, the next Higher Commanders are GHQ, Washington, and C.-in-C. U. S. Atlantic Fleet

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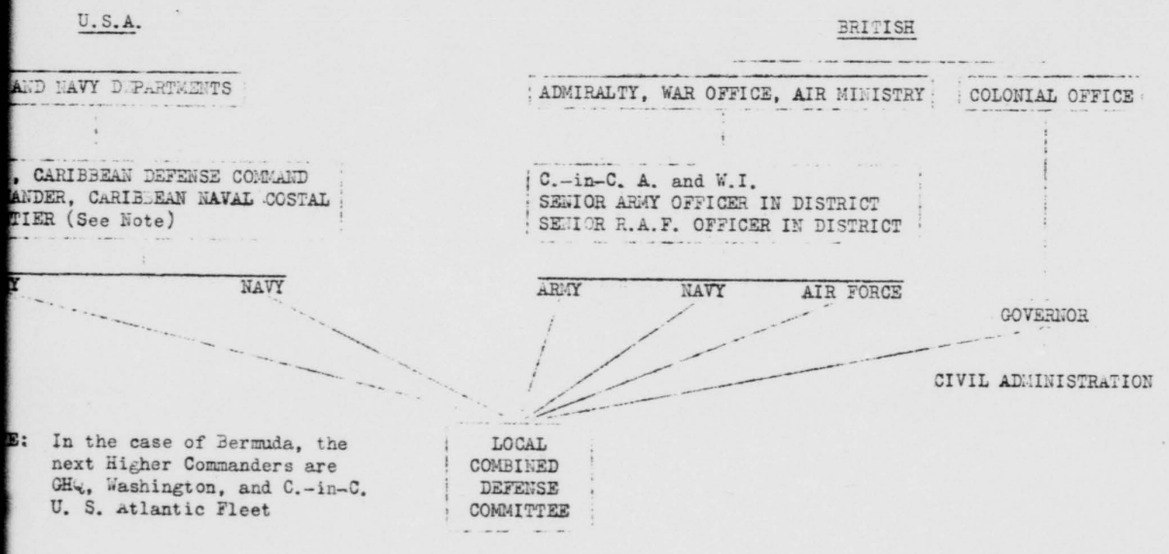
ANNEX I.

CHAIN OF COMMAND



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Plan-Employm of Bomb. Avia. in Defense of Oahu. (Study of Air Situation in Hawaii) /28

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A PLAN FOR THE EMPLOYMENT OF

BOMBARDMENT AVIATION

IN THE DEFENSE OF OAHU

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AIR MUNITIONS BLDG.
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RETURN TO AIR FORCE
AIR WAR PLANS DIVISION
MUNITIONS BLDG.

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HEADQUARTERS HAWAIIAN AIR FORCE
Office of the Air Force Commander
HICKAM FIELD, T. H.

(T-3)

In reply refer to:

14 August 1941

SUBJECT: Study of the Air Situation in Hawaii.

TO : Commanding General, Army Air Forces, Washington, D. C.

THRU : Commanding General, Hawaiian Department, Fort Shafter, T. H.

1. In compliance with copy of corrected memorandum for the Commanding General, Army Air Forces, OCS 17234-25, from the Secretary, General Staff, dated July 17, 1941, "that a study be made of the air situation in Hawaii", there is attached for consideration of the War Department, a Plan for the Employment of Bombardment Aviation in the Defense of Oahu. This plan clearly presents the air defense of the Hawaiian Islands. Attention is called to the recommendations therein.

2. When the RDF installation is completed and the 15th Pursuit Group has its full complement of airplanes, no further increase for pursuit aviation is considered necessary. Provision must be made to maintain the 14th Pursuit Wing at full combat strength at all times. It is contemplated that pursuit aviation will perform its normal mission in the defense of these islands by intercepting and destroying enemy aircraft in the vicinity of, or over, the Island of Oahu.

3. A combination medium bombardment-torpedo force is considered highly desirable in order that attacks can be made under conditions of low visibility and is therefore recommended as a component part of the Hawaiian Air Force. A study in connection with the use of this force is included in the plan submitted herewith.

H. T. Martin

F. A. MARTIN,
Major General, U. S. Army,
Commanding.

1 Incl-
Plan for the Employment
of Bombardment Aviation
in the Defense of Oahu.

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C O N F I D E N T I A L

PLAN FOR THE EMPLOYMENT OF BOMBARDMENT AVIATION IN THE DEFENSE OF OAHU

I. GENERAL:

1. The key to this plan is found in the provision for first, a complete and thorough search of the Hawaiian area daily during daylight; secondly, an attack force available on call to hit a known objective located as a result of the search and thirdly, if the objective is a carrier, to hit it the day before it could steam to a position offshore of Oahu where it could launch its planes for an attack.

2. The most difficult problem presents itself when it is necessary to search through 360°. This might occur daily and it is the only one considered in this study. It is possible, of course, that intelligence obtained from advanced naval bases and ships at sea might implement this plan and reduce the search area to 270°, 180° or even 90°. In this case, the striking force would be augmented by those planes not required for search.

3. All computations in connection with air operations under this plan are based on the B-17D airplane. This type of airplane is considered available for either a search mission or an attack mission and consequently no reference is made to reconnaissance or bombardment aviation as such but to the search or the attack forces. The combat crew training of both will be identical and search and attack missions will be rotated for the purpose of resting crews and maintaining aircraft.

II. THE PROBLEM:

1. To analyze the mission of heavy bombardment aviation in the defense of Oahu with a view to promulgating a plan in accordance therewith.

III. FACTS BEARING ON THE CASE:

1. Facts:

a. The Army mission is: "To defend the Naval Base of Oahu".

b. The bombardment mission is:

(1) When Navy reconnaissance is adequate:

"To attack and destroy enemy surface craft within radius of action."

(2) When Navy is absent or not present with equipment in Numbers or Quality:

"To search for, attack and destroy enemy surface craft within radius of action."

c. *Capabilities of B-17D type airplanes are:

(1) Search at 45% Power at 5,000' Altitude (No bombs--2500 gallons fuel)	Gal Fuel used	Miles flown
One hour full throttle operations	432	214
Two hour fuel reserve	272	
Climb	30	10
Cruise at 143 knots at 136 gal/hr	1766	1910
	2500	2134
Radius of Action in nautical miles		1067

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Plan for the Employment of Bombardment Aviation in the Defense of Oahu, cont'd:

	Gal Fuel used	Miles flown
(2) Search - Attack at 45% at 5,000'		
(4 - 600# bombs - 2100 gallons fuel)		
One hour full throttle operation	432	214
Two hours fuel reserve	272	
Climb	30	10
Cruise at 143 knots at 136 gal/hr	1366	1485
	2100	1709
Radius of Action in nautical miles		854
(3) Attack at 65% Power - Return at 45% Power at 15,000'		
(4 - 600# bombs - 2100 gallons fuel)		
One hour full throttle operation	432	236
Two hours fuel reserve at 45% power	272	
Climb	90	27
65% Power - 193 knots at 208 gal/hr	687	643
45% Power - 150 knots at 136 gal/hr	612	643
	2093	1549
Radius of Action in nautical miles		775
(4) Attack at 65% Power - Return at 45% Power at 15,000'		
(8 - 600# bombs - 1700 gallons fuel)		
One hour full throttle operation	432	236
Two hours fuel reserve at 45% power	272	
Climb	90	27
65% Power - 193 knots at 208 gal/hr	485	450
45% Power - 150 knots at 136 gal/hr	408	450
	1687	1163
Radius of Action in nautical miles	1700	581

*Note-- The above capabilities were taken from curves in the B-17D handbook and checked by actual flight tests.

d. To perform its missions, the Fleet must have freedom of action without responsibility for the defense of its base.

e. If the solution to a problem is designed to meet the most adverse conditions, any less adverse condition will facilitate the solution.

f. Army Air Force units at present are not charged with the reconnaissance mission for the defense of Oahu.

g. The combatant force having the longer range weapon has a basic advantage, other factors being equal.

h. The bombardment airplane is the longest range weapon which the Department Commander has at his disposal.

2. Assumptions:

a. The following are the assumed or known maximum capabilities of enemy equipment:

(1) Some of his carriers can steam at 30 knots for at least 24 hours. (Best available intelligence indicates ORANGE has three carriers with this performance).

(2) His carrier bombing planes have 600 nautical miles range and cruise at 180 knots (based on perfor-

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mance data of the U. S. Navy carrier planes and no allowance is made for take-off, rally after attack, full throttle operation and landing).

b. The following are the assumed probable capabilities of enemy equipment:

(1) His carriers steam at 27 knots for 24 hours. (28 knots is the mean top speed of his carriers; 1 knot reduction is made for four bottoms).

(2) His carrier bombing planes have 400 nautical miles range and cruise at 180 knots (reduction in range from 600 to 400 nautical miles is made to allow for take-off, rally after attack, full throttle operation and landing).

Note: In the discussion that follows it is assumed that hostile carriers operating under conditions a and b above once committed to action will steam straight in to their launching radius. Any maneuvering by the enemy when within our search area will simplify our problem for it will give the search force more time in which to locate the enemy.

c. The Hawaiian Air Force is primarily concerned with the destruction of hostile carriers in this vicinity before they approach within range of Oahu where they can launch their bombardment aircraft for a raid or an attack on Oahu.

d. An enemy will not venture an attack against the Hawaiian Islands until control of sea lanes of communication is obtained. Then as the enemy fleet approaches these islands, raids by surface vessels, submarines and carrier-based aircraft, may be expected.

e. Our most likely enemy, ORANGE, can probably employ a maximum of 6 carriers against Oahu.

f. A 25-mile visibility is assumed. This assumption is based on standard U. S. Navy search and patrol methods employed in this area.

g. For the purpose of this problem the day is divided into 13 hours of daylight and 11 hours of darkness. These assumptions are based on the following computations:

(1)	June 22, 20° N. Lat., Sunrise	0521
	Sunset	1842
	Hours of daylight	1321
	Add: Morning Twilight	25
	Evening Twilight	24
	Total hours of daylight	14:10
(2)	December 21, 20° N. Lat., Sunrise	0630
	Sunset	1750
	Hours of daylight	1120
	Add: Morning Twilight	24
	Evening Twilight	24
	Total hours daylight	12:08
	Average (1) and (2)	13:09

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Plan for the Employment of Bombardment Aviation in the Defense of Oahu, cont'd:

IV. DISCUSSION:

Part 1: The Search:

1. The only manner in which the Hawaiian area can be thoroughly searched for enemy surface craft, particularly aircraft carriers, in the event of a situation requiring such action, is to provide a sufficient number of aircraft to conduct a daily search of a desired area during daylight hours with 100% coverage through 360°. A method of searching 5° sectors through 360° to a radius of 833 nautical miles from Oahu employing 72 B-17D airplanes is indicated in Chart No. 1. It will be noted that the outside lines of visibility for the diverging tracks cross at the 600 nautical mile circle, the overlap area inside of that distance becoming a non-covered area beyond that distance. The width of the non-covered area increases as the distance increases beyond 600 nautical miles with the corollary that the probability of finding the target decreases as the search continues out. However, as can be seen on the chart, each search plane on the search back covers the area not covered between any two planes on the search out and, in addition, covers the area previously searched by the plane on its left on the search out but uncovered on the search back. 100% coverage of the area is, therefore, obtained on the search out and back.

2. In order to have available for ready reference a means of determining coverage and non-coverage of areas on the search out using 3°, 4° and 5° sectors, there is attached Chart No. 2. The method of constructing the curves thereon is indicated on the chart. It will be observed that, with the assumed visibility of 25 miles, 100% coverage on the search out is obtained to a radius of:

a. 600 nautical miles with airplanes in 5° sectors.

b. 750 nautical miles with airplanes in 4° sectors.

c. 1000 nautical miles with airplanes in 3° sectors.

3. Under any given set of operating data for the search planes and enemy carrier, the radius of action of the search force is determined by:

a. Rate of closure of the carrier and search planes.

b. Minimum distance the carrier can be offshore and allow the search force to make interception and relay the information to the attack force.

c. Minimum time required for the attack force to make interception beyond the radius of action of the carrier planes.

4. In developing this plan, all search aircraft take off at daylight. They might take off during darkness in order to be at a certain location at dawn if definite information as to the movements of enemy surface vessels is reported from some source such as our search of a previous day, friendly surface vessels or Navy patrol.

Part 2: This part of the discussions deals with the maximum capabilities of enemy equipment namely, his carriers steam at 30 knots and his bombing planes have 600 nautical-miles range and cruise at 180 knots. See Chart No. 3.

1. Section No. 1:

a. An enemy should be primarily interested in obtaining the maximum cover of darkness for his carrier approach. This section illus-

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trates four possible uses of darkness by an enemy to cover his approach. In each case the distance out for dusk and dawn is computed from the most distant aircraft launching circle, or 350 nautical miles. This figure is based on the fact that after launching, the carrier planes will be in the air 3:20 and during that time the carrier steams in 100 nautical miles to recover its planes.

b. 1A shows a carrier launching its aircraft at midnight, attacking and recovering during darkness; 1B shows the launching at dusk with the attack and recovery during darkness; 1C shows the launching at noon with the attack and recovery during daylight; and 1D shows the launching at dawn with the attack and recovery during daylight.

c. It will be noted that each time schedule has a daylight period within the radius of action of the attack force but that 1D permits the least time interval for our forces to operate against an enemy and requires it to attack at the longest range. The early morning attack is, therefore, the best plan of action open to the enemy.

d. It is the opinion of some individuals that a late afternoon attack is highly probable since it permits an enemy carrier to escape under cover of darkness. This presupposes that search operations are impracticable. This headquarters cannot subscribe to this opinion for the following reasons:

(1) A minor surprise raid such as a single carrier is not a logical method of attack to reduce the defenses of Oahu.

(2) It permits us to operate against him for a long period on D Day at close range.

(3) The enemy will be more concerned with delivering a successful attack than he will be with escaping after the attack. He will have carefully considered the cost of the enterprise, will probably make a determined attack with maximum force and will willingly accept his losses if his attack is successful.

2. Section No. 2:

a. This section illustrates a routine daily search by the search force which will be made in order to prevent an enemy from making an undetected approach on Oahu.

b. Specifically, with the carrier approaching at 30 knots and the search force taking off at dawn, interception must be made no closer to Oahu than 435 nautical miles and no later than 3:03 after dawn on D Day. This permits 40 minutes to send a radio message to the home base and get the attack force in the air and 2:10 for it to intercept and deliver its attack before the carrier can launch its planes. The attack force will strike the carrier at its dawn plus 5:34 D Day, 359 nautical miles out.

c. On a time distance basis, dawn D Day for a carrier is 526 nautical miles from Oahu; dusk D Day-1 is 856 nautical miles out and dawn D Day-1 is 1246 nautical miles from Oahu. Solving the rate of closure problem for the two forces 1246 nautical miles apart, it is found that contact will be made at 1030 nautical miles from Oahu at carrier's dawn plus 7:12 on D Day-1.

d. It must be pointed out that this solution is the maximum radius of action for the search force, yet not necessarily the most difficult problem presented to our attack force. While a carrier arriving at

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the 1030 nautical mile circle at dawn plus 7:12 on D Day-1 cannot be attacked that day, it can be attacked the following day as shown in b above when it must come within easy range of the attack force if it is to attempt to steam to within its launching radius.

3. Section No. 3:

a. This section illustrates the most difficult problem which the attack force has to solve. It is the same problem that is illustrated in Section No. 1D. The critical point here is the carrier's position at his launching radius at dawn. Under these circumstances he is able to launch his aircraft before we intercept him and deliver an attack against him on D Day. Therefore, we must hit him D Day-1, or the day before he arrives at this position.

b. Specifically, if his dawn position D Day is 350 nautical miles from Oahu, his dusk position D Day-1 must be 680 nautical miles out and his dawn position D Day-1 must be 1070 nautical miles out. If he makes good this schedule, interception by the search force will be made at 884 nautical miles out at his dawn plus 6:11 on D Day-1. Allowing 40 minutes to transmit a message and to get the attack force in the air, the attacking force will strike the carrier at its dawn plus 10:43 D Day-1 at a distance of 748 nautical miles from Oahu and can operate against it during the remaining 2:16 before dusk. Under the most favorable condition for the enemy, the enemy carrier can be subjected to attack by our attacking force during a period of 2:16 on D Day-1.

4. Section No. 4: This section shows the radius of action of the B-17D type airplane with full load of bombs and 1700 gallons of fuel.

5. Effect of Visibility (See Chart No. 2):

a. To cover the required search area under the above conditions 120 airplanes, each covering a 3° sector, would be needed to operate to a distance of 1030 nautical miles. This number of planes would permit 100% coverage of the entire 360° on the search out.

b. Obviously any decrease in the number of planes employed will increase the sector to be searched by each plane and therefore reduces the probability of finding the target. Any uncovered area would, however, with a lesser number of search planes be covered on the search back, and depending upon the location of the carrier and the hour of the day, might permit an attack to be made on D Day-1 or D Day.

Part 3: This part of the discussion deals with the assumed probable capabilities of enemy equipment (see Chart No. 4). It is believed that his maximum capabilities will be reduced from those assumed for Sections 1 to 4, inclusive, (Chart No. 3) by the following factors:

1. His average carrier top speed will be 27 knots. This statement is predicated upon the fact that the average top speed of ORANGE carriers is 28 knots, and the belief that on his run across the Pacific, foul bottoms will probably further reduce his speed.

2. The cruising range of his carrier aircraft will be 400 nautical miles. No allowance is made in previous computations for full throttle operation, for fuel reserve, or for time required to take off from, and land aboard, the carrier.

3. He will not have unlimited avenues of approach for his attack.

a. He must avoid the shipping lanes to negate detection.

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Plan for the Employment of Bombardment Aviation in the Defense of Oahu, cont'd:

b. Any approach to Oahu which is made from east of the 158th meridian materially increases his cruising distance and the probability of detection by friendly surface vessels. It seems that his most probable avenue of approach is the hemisphere from 0° counter-clockwise to 180° around Oahu; the next most probable, the quadrant 180° counter-clockwise to 90°; the least probable, 90° to 0°.

c. The tactical search enunciated above is not the only source of information as to his movements. Office Naval Intelligence, surface scouting forces, commercial ships at sea, radio intercept and proposed advance naval line patrol, will tend to disclose his general location and might, therefore, reduce the search area for our forces.

d. He will want to take the shortest distance to his objective, although this will be of minor consideration if his range is sufficient to permit him the long approach.

4. Section No. 5:

a. This section has been drawn to show one possible plan of attack of the enemy under his assumed probable capabilities. Here consideration has been given to the factors enumerated in paragraphs 1, 2 and 3 immediately above, with the result that his performance characteristics have been reduced to 27 knots speed for his carrier and to 400 nautical miles range for his airplanes. Under these conditions it will be necessary for the carrier to approach within 233 nautical miles of Oahu before it can launch its aircraft; recovery would be made at 167 nautical miles. Accordingly, the radius of search can be reduced to 833 nautical miles and still permit the search force to locate the carrier and the attack force make its attack before the carrier-based aircraft can be launched. These assumed characteristics can reduce the required search radius to 833 nautical miles and still permit the carrier being attacked before it reaches the position from which aircraft can be launched.

b. If on D Day-1 the carrier force is at a distance of 991 nautical miles steaming in at 27 knots and the search force takes off at dawn, interception will occur at the carrier's dawn plus 5:49, 833 nautical miles away, the maximum radius of search under these conditions. Allowing 40 minutes to order the attack force out and 3:42 for the flight, the carrier can be attacked at its dawn plus 10:11 D Day-1, 715 nautical miles out and can operate against it during the remaining 2:49 before dusk.

c. Further, should the carrier be missed on D Day-1 there still remains an opportunity to attack it on D Day. Interception must be made by the search force not nearer than carrier's dawn plus 2:02, 288 nautical miles out on D Day in order to make an attack prior to launching. This attack would occur at dawn plus 3:56, 237 nautical miles out.

5. Section No. 6: The problem here is the same as that shown in paragraph 3, Part 2 above, i.e., the most favorable plan of action open to an enemy. With the carrier making good its time schedule to arrive at its airplane launching position at daylight, interception by the search force will be made at dawn plus 5:11 of carrier's D Day-1. Allowing 40 minutes to transmit the message to the home base and for the attack force to take off, the attack force can reach the carrier at dawn plus 9:08 of carrier's D Day-1 and can operate against the carrier during the remaining 3:42 before dusk. Under the most probable plan of action of an enemy carrier, a B-17D attacking force can operate against the carrier for 3:42 of the day prior to his attack on Oahu.

6. Effect of Visibility:

a. In Section No. 5, a 5° search spread should give adequate coverage. The search time schedule is such that if interception is not made on the search out it can be made on the search back in time to transmit the information and to deliver an attack by the striking force before

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dusk on D Day-1. There is 75% coverage at 800 nautical miles on the search out, but on the search out and back there is 100% coverage. 72 airplanes would be used for the search.

b. In Section No. 6, with 5° search sectors, the probability of finding the target at 740 nautical miles is 85% for the search out and as stated in a above, 100% for the search out and back. 72 airplanes would be sufficient for complete coverage in this case, for if interception is not made on the way out, it can be made on the search back in time to transmit information and deliver an attack.

V. CONCLUSION:

1. Action by enemy carrier-based bombing planes against Oahu should be figured on the basis of their having 400 nautical miles range and a speed of 180 knots.

2. a. The most favorable plan of action open to the enemy, and the action upon which we should base our plans of operation, is the early morning attack in which the enemy must make good the following time schedule:

(1) Cross circle 881 nautical miles from Oahu at dawn of the day before the attack.

(2) Cross circle 530 nautical miles from Oahu at dusk of the day before the attack.

(3) Launch his planes 233 nautical miles from Oahu at dawn the day of the attack.

(4) Recover his planes 167 nautical miles from Oahu 2:30 after dawn the day of the attack.

b. Any variation from the above time schedule permits our attack force to strike the enemy during daylight of the day before his attack over a greater time interval and at a shorter range; or, permits our attack force to strike him during daylight of the day he attacks but before he is within his radius of action of Oahu. If an enemy carrier succeeded in slipping in undetected by our search force and launched an attack, we could and would, of course, attack as soon as possible in order to destroy or disable the carrier prior to, or during, the recovery of its planes.

3. The area between the circles with radii 530 nautical miles and 833 nautical miles from Oahu is the operating area for the solution of this problem under its most adverse condition.

4. a. With the Army Air Force responsible for its own reconnaissance, 72 B-17D airplanes will be required to search daily the area within the circle of 833 nautical miles radius from Oahu, each plane covering a 5° sector.

b. Based upon the assumption of visibility used in this study, 72 airplanes employed to search a 360° sector should result in 100% coverage with some overlap to 600 nautical miles, 85% coverage at 700 nautical miles and 75% coverage at 800 nautical miles in the search out. In every case, the search out and in would permit 100% coverage within the time interval which would allow the launching of the bombing attack prior to dusk on D Day-1.

5. If a similar search could be conducted from Dutch Harbor, Midway, Johnston or Palmyra the possibility of enemy surface ships approaching Hawaii and the west coast of the United States undetected would be practically non-existent.

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Plan for the Employment of Bombardment Aviation in the Defense of Oahu, cont'd:

6. Search must be conducted during daylight hours because of the extreme difficulty of locating what will be an unlighted objective proceeding under cover of darkness. The B-17D airplane is capable of searching for, and attacking, an enemy force the day prior to its arrival within its striking distance of Oahu.

7. With this plan in actual operation the defenses of these islands can be assured without assistance from the Navy. This will permit complete freedom of action of the Pacific Fleet.

8. The B-17D airplane is capable of operating beyond the combat range of any known enemy carrier-based aviation.

9. Attack must be conducted during daylight hours because it is considered impracticable to locate and bomb a maneuvering precision target during darkness.

10. Based on the worst situation that could arise, i.e., the employment of 6 enemy carriers against Oahu simultaneously each approaching on a different course, an attack force of 36 B-17D's would be required to disable or destroy the carriers. It is expected that 6 B-17D's with bomb loads of seven 600# bombs would be sufficient to accomplish the desired result (see Study No. 1). It is contemplated that this attack force will be augmented by 36 additional B-17D's of the maintenance and reserve force if in commission. This attack force should be further augmented by a minimum of 36 long-range planes of the B-26 or similar type, capable of carrying torpedoes to be used as the striking force under conditions of low ceiling and visibility when high altitude level bombing technique is not practicable. (See Study No. 2).

11. A reserve of 72 planes will be needed to provide for maintenance, replacement and reserve for both the search and attack forces. As was stated in paragraph 10 above, 36 of this number may be employed as part of the attack force if in commission.

12. In order to operate the above number of B-17D's, a minimum of 216 combat crews will be needed as indicated in Chart No. 5. It is estimated that a 50% reserve of medium bomber-torpedo plane crews would be sufficient for operations giving a total of 54 desired.

VI. RECOMMENDATIONS:

1. It is recommended that the War Department give immediate consideration to the allotment of 180 B-17D type airplanes or other four-engine bombers with equal or better performance and operating range and 36 long-range torpedo-carrying medium bombers to the Hawaiian Air Force for the performance of search and attack missions in an area bounded by a circle whose radius is 833 nautical miles and center is Oahu, as follows:

72 for daily search missions.
36 for attack missions (these airplanes will be in readiness daily, fully armed and loaded with bombs, for a mission).
72 for maintenance and reserve from which 36 may be used to augment the attack force.
180 total B-17D's.
36 torpedo-carrying medium bombers of the B-26 or other suitable type.

2. While this number of bombardment airplanes could not be accommodated at Hickam Field and there are not other suitable bases available on Oahu, it is only a matter of time until airdromes under construction on outlying islands of the Hawaiian group are completed and will be available for operations of the above number of planes. Existing plans for the

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dispersion of the 19th Bombardment Wing (H) provide for units of one and two squadrons to operate from dispersed airdromes. Modification of the plan to apply to operations therefrom are anticipated and will be made.

3. It is further recommended that in making future allotments of officers and enlisted men to the Hawaiian Air Force consideration be given to providing a minimum of 216 B-17D combat crews, 54 medium bomber-torpedo combat crews and duplicate maintenance crews for the B-17D's.

4. Our leading tacticians and strategists here concur in the opinion that this plan will solve the defense of the Hawaiian Islands and that to their knowledge it is the best and only means that can be devised to locate enemy carriers and make attacks thereon before said carriers can come within launching distance of Oahu. The sole purpose of the existence of the military establishment on Oahu, ground and air, is for the defense of Oahu as an outlying naval base. The best defense is an aggressive and well organized offense. The basis of this plan is offensive action. We have had clearly demonstrated to us in Europe the fallacy of depending upon passive measures of defense. We must not base our plans of action on the "Defense of Hawaii", but rather upon a vigorous offensive. We must ferret out the enemy and destroy him before he can take action to destroy us.

It has been said, and it is a popular belief, that Hawaii is the strongest outlying naval base in the world and could, therefore, withstand indefinitely attacks and attempted invasions. Plans based on such convictions are inherently weak and tend to create a false sense of security with the consequent unpreparedness for offensive action.

In order to initiate offensive action, the Hawaiian Air Force must have at its immediate command well organized, equipped and trained combat crews. It should be remembered that while reinforcements from the Mainland can be made available on short notice their expeditious presence here will not solve the problem. Upon their arrival they must be given an opportunity to undergo a certain amount of indispensable indoctrination and training in the plan of action of the Hawaiian Air Force. If this plan is to be effective the force recommended above must be made a reality and maintained in existence for combat at any time. With the United States living and working under a condition of unlimited National Emergency, Japan making its southward movement and the world in general in a complete state of turmoil we must be prepared for D Day at any time. Reinforcements, therefore, must be considered from the standpoint of replacements for losses only. Any delay in placing this plan in operation, such as would be necessary for the above reasons, would mitigate against its success.

It is believed that a force of 180 four-motored aircraft with 36 long-range torpedo airplanes is a small force when compared with the importance of this outpost. This force can be provided at less cost to the Government than the cost of one modern battleship. It is further believed that this force should be made available as soon as possible even at the expense of other units on the Mainland.

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STUDY OF THE BOMBS REQUIRED TO DISABLE AN AIRCRAFT CARRIER

1. It is assumed that two direct hits by 500 lb. or 600 lb. demolition bombs will be sufficient to disable an aircraft carrier.

2. From the tables of probability of direct hits by bombing, results obtained by units of the Hawaiian Air Force in bombing sleds towed by Navy surface craft and from previous experiences by bombardiers who have made attacks of this nature, it is determined that about 90% probability of two direct hits may be expected from 6 B-17D's or similar type airplanes attacking a maneuvering carrier from 15,000 feet, each dropping seven 600 lb. bombs in train. Bombardiers are assumed to be capable of at least a 20 mil accuracy.

3. In arriving at the number of bombs and airplanes required, several methods of attack are considered:

a. Attack by individual airplanes from different directions, attacking in close succession.

b. Formation attacks by three plane elements from different directions and in close succession.

c. Formation attack in a 6-plane flight.

In all cases bombs are assumed to have been dropped in train by each airplane with a spacing of 80 feet between bombs. The number of bombs (42) and airplanes (6) required to give a 90% probability of two effective hits was determined to be nearly the same for each type of attack.

STUDY NO. 1

STUDY-1

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NEED FOR TORPEDO PLANES IN THE HAWAIIAN AIR FORCE

1. a. Any or all of the following factors could be expected to partially or wholly prevent the successful actomplishment of the bombardment mission:

(1) Inability to find enemy force (navigation).

(2) Lack of bombing accuracy.

(3) Enemy fighter action.

(4) Hostile anti-aircraft artillery fire.

(5) Weather obscuring the objective.

b. Consideration of these factors:

(1 and 2) Navigational and bombing accuracy are primarily matters of training and practice. Efficient standards can be and are being attained by the training of combat crews in the Hawaiian Air Force.

(3) The critical altitude, high speed and defensive armament of the present heavy bombardment aircraft is such as to provide excellent defense against enemy fighters. It is not believed that carrier-based fighters will be very effective against the B-17D's at high altitudes.

(4) Reports from abroad indicate that anti-aircraft fire will be only partially effective and will not prevent the accomplishment of the mission.

(5) The weather of the Hawaiian Islands is probably the best in the world from a standpoint of flying conditions and yet a very definite percentage of bombing missions fail because of overcast conditions which obscure the objective. Heavy bombardment as such is useless against surface craft when low ceilings (200 - 1,000 feet) prevail, and it is doubtful if it could be used below 5,000 feet without prohibitive losses from anti-aircraft fire before reaching the bomb release line. Enemy surface craft may be expected to take full advantage of all cloudiness conditions and even to wait until such conditions occur before launching an attack. At present the Hawaiian Air Force has no weapon to effectively combat surface craft under such conditions.

2. The following is submitted as a solution to this problem:

a. The most effective action against surface craft under poor weather conditions is believed to be a torpedo attack from low flying aircraft. This is substantiated by results from abroad, i.e., Bismarck sinking, Taranto attack, etc.. A torpedo plane flying just off the water can operate under a very low ceiling and with guaranteed accuracy

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against all surface craft. The torpedo plane should be land-based, of long range, fast and capable of being accurately navigated. It should operate in conjunction with heavy bombardment.

3. a. The only type airplane that could be adapted to this purpose at present in the Hawaiian Department is the A-20A. It is believed that this adaptation can be made and the problem is under consideration and test at present.

b. It is believed that the medium bombardment airplane of the B-26 type will be even more satisfactory because of its longer range.

c. It is recommended that adaptation of some such airplane be made, preferably in such a manner as not to interfere with the normal bombardment mission.

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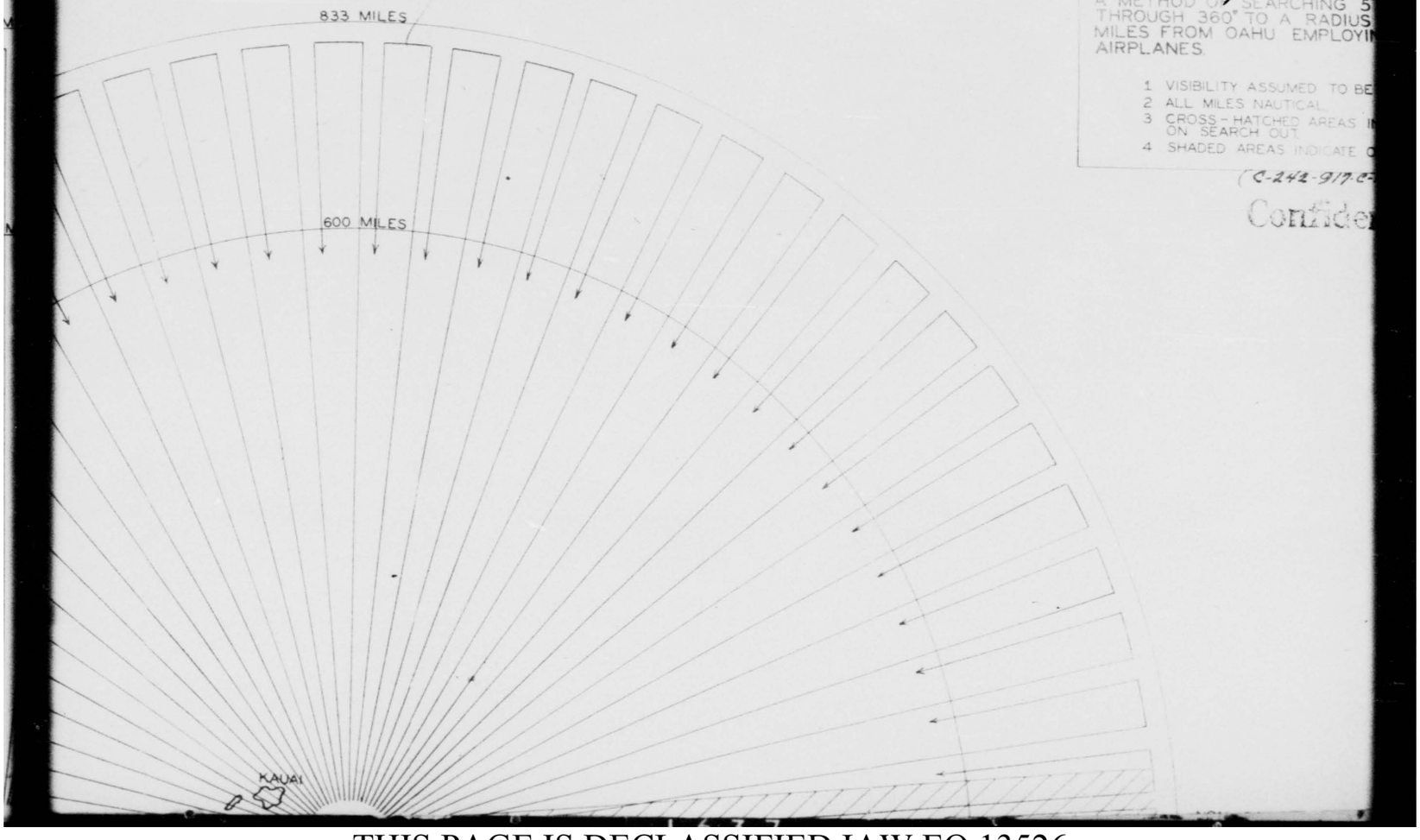

A METHOD OF SEARCHING 5
THROUGH 360° TO A RADIUS
MILES FROM OAHU EMPLOYIN
AIRPLANES.

1 VISIBILITY ASSUMED TO BE
2 ALL MILES NAUTICAL
3 CROSS-HATCHED AREAS I
ON SEARCH OUT
4 SHADED AREAS INDICATE O

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A METHOD OF SEARCHING 5° SECTORS THROUGH 360° TO A RADIUS OF 833 MILES FROM OAHU EMPLOYING 72 B-17D AIRPLANES.

1 VISIBILITY ASSUMED TO BE 25 MILES.
2 ALL MILES NAUTICAL.
3 CROSS-HATCHED AREAS INDICATE COVERAGE ON SEARCH OUT.
4 SHADED AREAS INDICATE OVERLAP.

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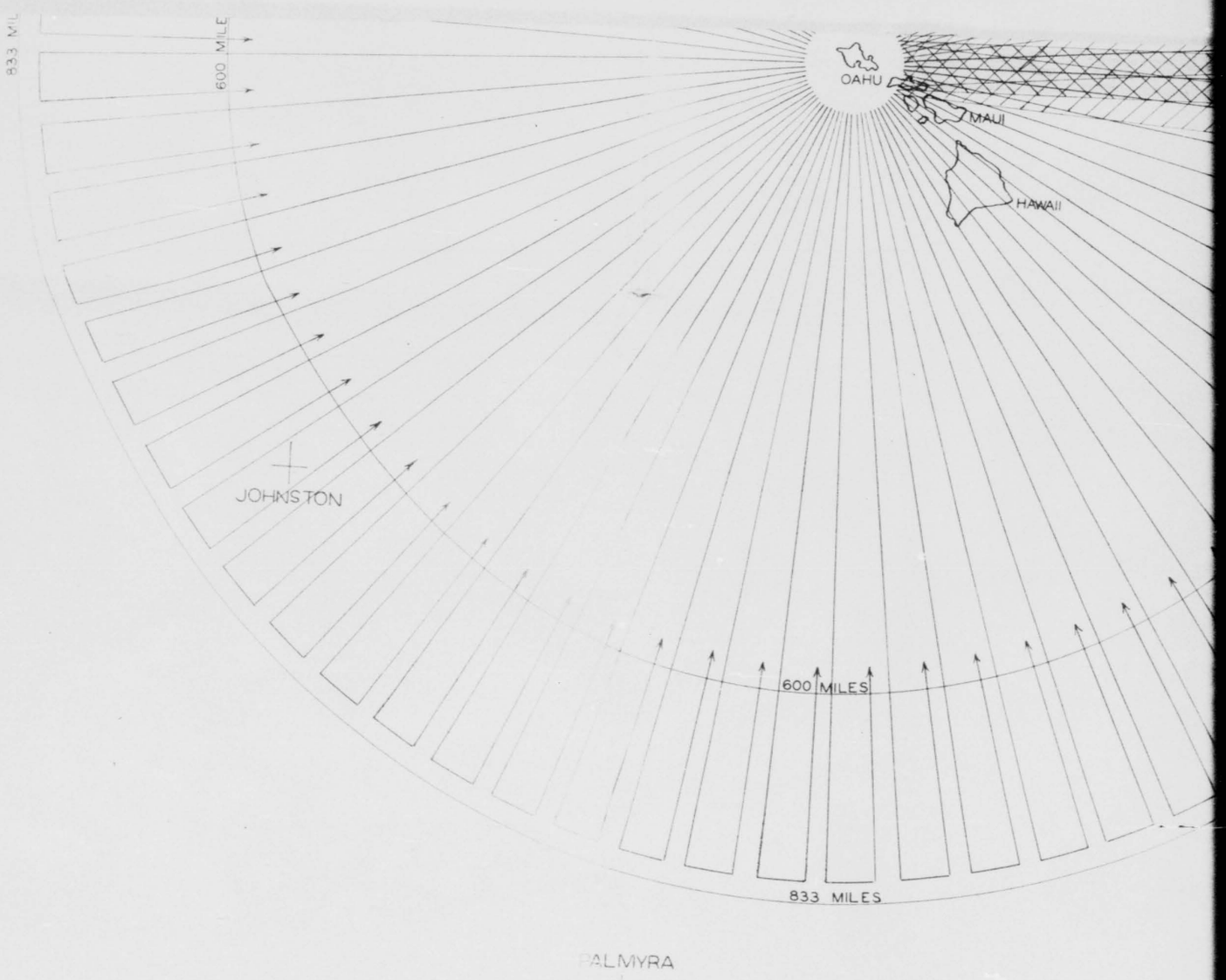

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CHART 1

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METHOD OF CONSTRUCTING CURVES

1. These curves apply to the search out only.

2. This explanation is based on the 5° search sector. The principal employed in constructing the 5° curve applies in the construction of the curves for the 3° and 4° search sectors.

3. At sixty (60) nautical miles, 1° equals one (1) mile. At 1200 nautical miles 5° equals 100 miles. Since the area that can be searched by one plane at any time with 25 miles visibility, is 25 miles to either side, the area that can be covered on the search out between two planes is 50 nautical miles. Therefore at 1200 miles, 50% coverage is obtained.

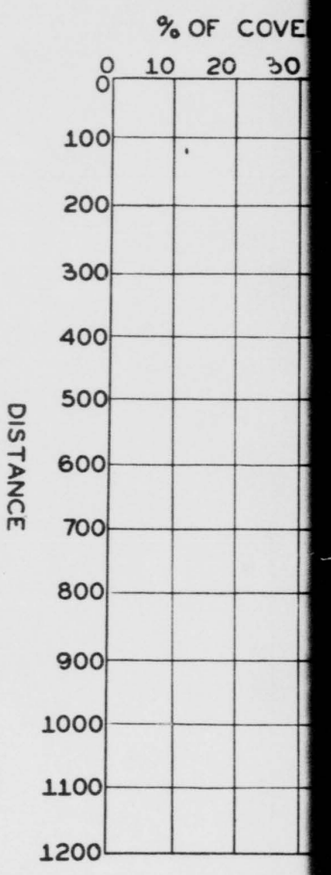
4. From the solution above the following working formula can be applied to plot the curves:

$$\frac{\text{60 nautical miles}}{\text{Search radius in nautical miles}} \times \frac{\text{50 nautical miles}}{\text{Degree of search sector}}$$

If the answer is greater than one, it indicates coverage in excess of 100% and, therefore, overlap.

For example at 300 miles:

$$\frac{\cancel{60}\ 10}{\cancel{300}\ 5} \times \frac{50}{5} = 2 \text{ or, } 100\% \text{ overlap.}$$



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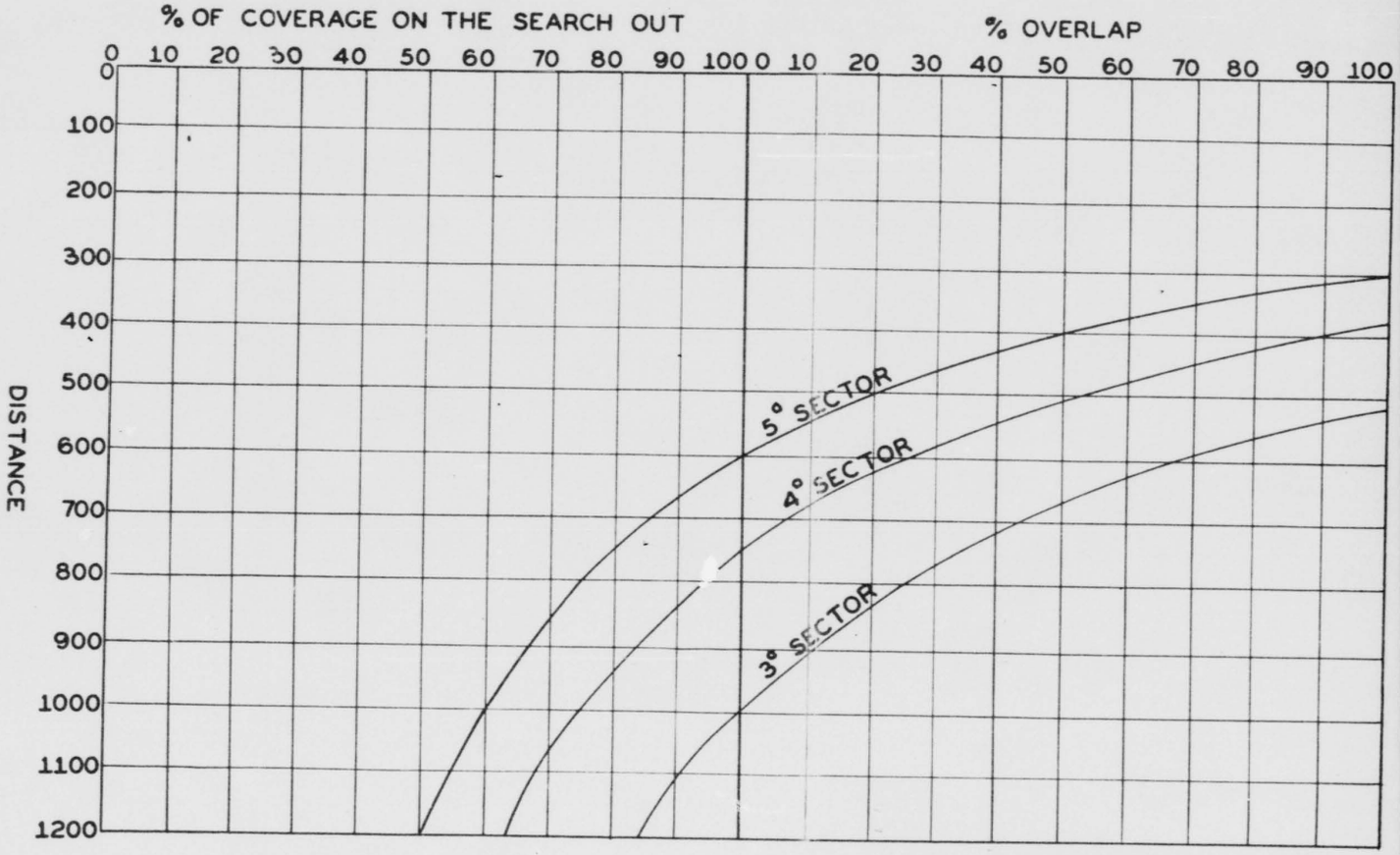
RELATION OF 25 MILE VISIBILITY TO DISTANCE



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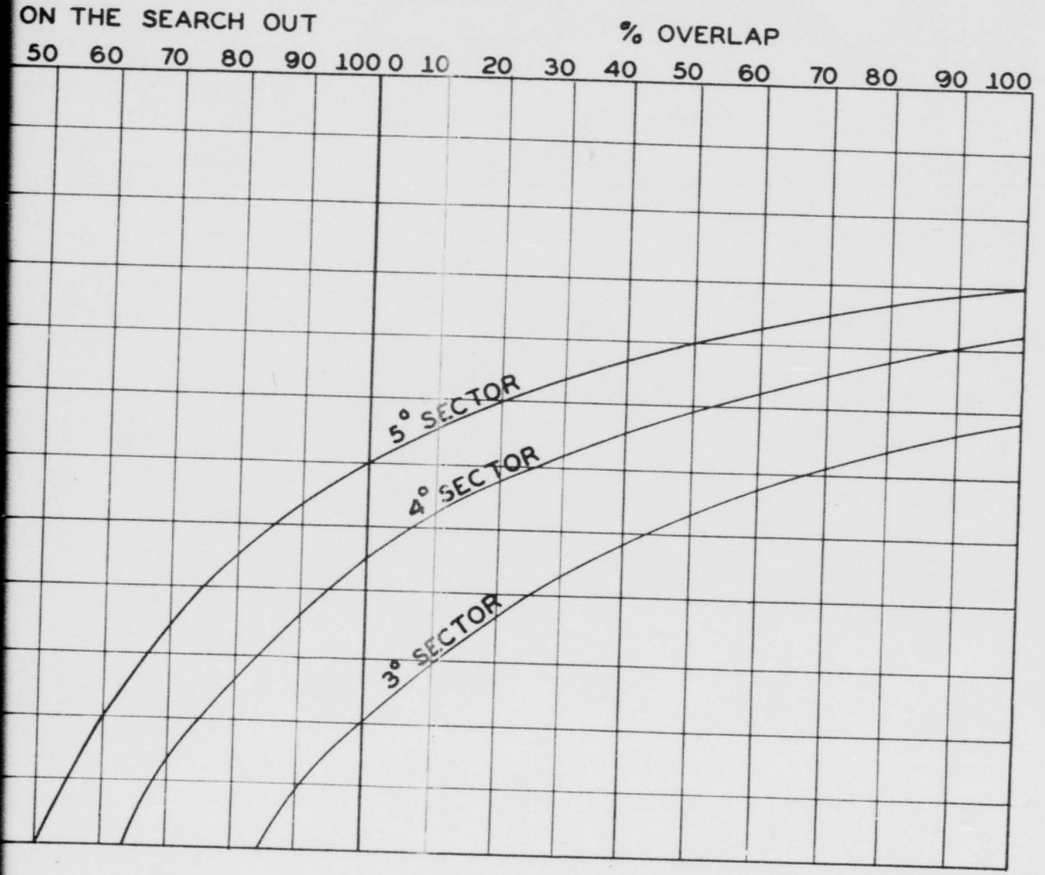
ATION OF 25 MILE VISIBILITY TO DISTANCE



(C-242-917C-17)(8-9-41) - CHART 2

CHART-2

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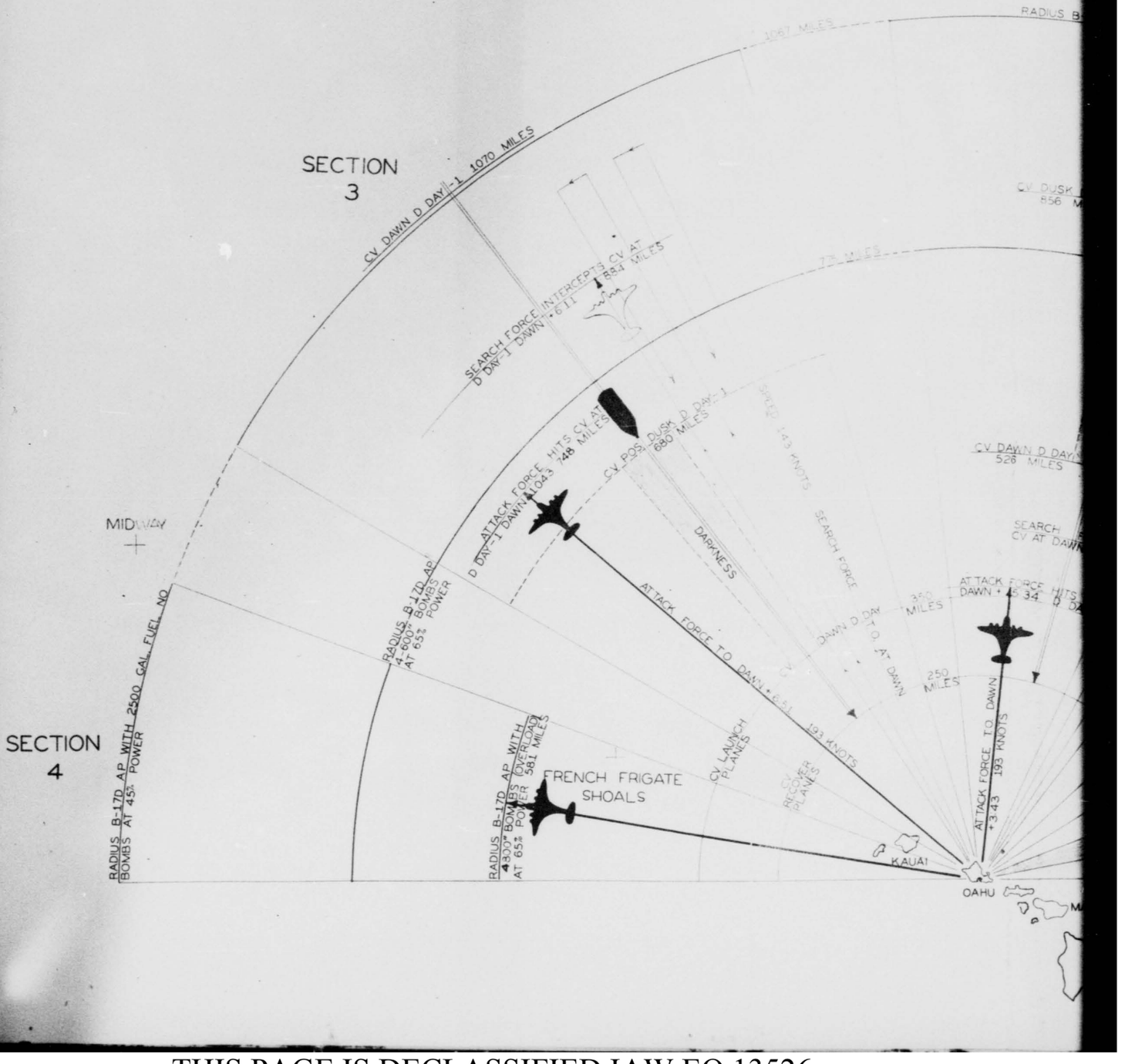
1. RADIUS OF ACTION OF B-17D AIRPLANE: UNDER VARIOUS LOAD CONDITIONS IN RELATION TO POSSIBLE PLANS OF A CARRIER GROUP ATTACKING OAHU.
2. MILES SHOWN ARE NAUTICAL MILES.
3. SECTIONS 2&3 INDICATE ONLY TWO OF MANY CONDITIONS THAT MIGHT OCCUR DURING A 360° SEARCH.



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4. PERFOMANCE OF B-17D AIRPLANE:
FOR EACH RADIUS OF ACTION ALLOWANCE IS MADE FOR 1HR. FULL THROTTLE OPERATIONS AND 2HR. FUEL RESERVE.

A. RADIUS OF SEARCH 1067 MILES
2500 GAL. FUEL, NO BOMBS
45% POWER OUT AND BACK
5,000 FEET ALTITUDE, 143 KNOTS.

B. RADIUS OF ATTACK FORCE 775 MILES
2093 GAL. FUEL, 4-600# BOMBS
65% POWER OUT, 45% BACK
15000 FEET ALTITUDE, 193 KNOTS OUT

C. RADIUS WITH MAXIMUM BOMB LOAD 588 MILES
1700 GAL. FUEL, 8-500# BOMBS
65% POWER OUT, 45% BACK, 15000 FEET
ALTITUDE, 193 KNOTS OUT

5. ASSUMPTIONS:
A. CARRIER SPEED 30 KNOTS
B. CARRIER PLANES PERFORMANCE
600 MILE RANGE AT 180 KNOTS
C. DAYLIGHT 13 HOURS, DARKNESS 11 HOURS
D. VISIBILTY 25 MILES
E. NO WIND

(C-242-9/7C-17)(8-9-41)

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SECTION 2

CV DAWN D DAY -1
1246 MILES

RADIUS B-17D AP WITH 2500 GAL FUEL NO BOMBS AT 45% POWER

SEARCH FORCE INTERCEPTS CV AT D DAY -1 DAWN +7.12 1330 MILES

CV DUSK D DAY-1
856 MILES

1067 MILES

143 KNOTS

DARKNESS

CV DAWN D DAY
526 MILES

RADIUS B-17D AP 1-500# BOMBS AT 65% POWER

SEARCH FORCE TO AT DAWN

SEARCH FORCE INTERCEPTS CV AT DAWN +3.03 D DAY 435 MILES

ATTACK FORCE HITS CV AT DAWN +5.34 D DAY 359 MILES

350 MILES

250 MILES

CV LAUNCH PLANES

CV RECOVER PLANES

ATTACK FORCE TO DAWN +3.43 193 KNOTS

DARKNESS

DARKNESS

DARKNESS

DARKNESS

DARKNESS

DARKNESS

DAWN

NOON

DUSK

MIDNITE

1067 MILES

A

B

C

D

SECTION 1

CHART 3

KAUAI

OAHU

MAUI

HAWAII

CHART 3

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4. PERFOMANCE OF B-17D AIRPLANE:
FOR EACH RADIUS OF ACTION ALLOWANCE IS MADE FOR 1HR. FULL THROTTLE OPERATIONS AND 2HR. FUEL RESERVE.

A. RADIUS OF SEARCH 1067 MILES.
2500 GAL. FUEL NO BOMBS
45% POWER OUT AND BACK
5,000 FEET ALTITUDE 143 KNOTS.

B. RADIUS OF ATTACK FORCE 775 MILES
2093 GAL. FUEL 4-600# BOMBS
65% POWER OUT 45% BACK
15000 FEET ALTITUDE 193 KNOTS OUT

C. RADIUS WITH MAXIMUM BOMB LOAD 588 MILES
1700 GAL. FUEL 8-500# BOMBS
65% POWER OUT, 45% BACK 15000 FEET
ALTITUDE 193 KNOTS OUT

5. ASSUMPTIONS:
A. CARRIER SPEED 30 KNOTS
B. CARRIER PLANES PERFORMANCE
600 MILE RANGE AT 180 KNOTS
C. DAYLIGHT 13 HOURS, DARKNESS 11 HOURS
D. VISIBILITY 25 MILES
E. NO WIND

(C-242-9/7C-17/8-9-41)

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SECTION 2

CHART 3

CHART 3

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SECTION 6

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SECTION 5

1. RADIUS OF ACTION OF B-17D AIRPLANE UNDER VARIOUS CONDITIONS IN RELATION TO POSSIBLE PLANS OF ACTION OF A CARRIER GROUP ATTACKING OAHU.
2. MILES SHOWN ARE NAUTICAL MILES.
3. SECTIONS 5&6 INDICATE ONLY TWO OF MANY CONDITIONS THAT MIGHT OCCUR DURING A 360° SEARCH.
4. PERFORMANCE OF B-17D AIRPLANE FOR EACH RADIUS OF ACTION ALLOWANCE IS MADE FOR 1HR FULL THROTTLE OPERATION AND 2HR RESERVE.
   - A. RADIUS OF SEARCH 1067 MILES
     2500 GAL FUEL NO BOMBS
     45% POWER OUT AND BACK
     10000 FEET ALTITUDE 143 KNOTS
   - B. RADIUS OF ATTACK FORCE 775 MILES
     2093 GAL FUEL 4-600# BOMBS
     65% POWER OUT 45° BAC
     15000 FEET ALTITUDE 193 KNOTS
   - C. RADIUS WITH MAXIMUM BOMB LOAD 588 MILES
     1700 GAL FUEL 8-500# BOMBS
     65% POWER OUT 45° BACK
     15000 FEET ALTITUDE 193 KNOTS
5. ASSUMPTIONS
   - A. CARRIER SPEED 27 KNOTS
   - B. CARRIER PLANES PERFORMANCE
   - C. DAYLIGHT 14 HOURS DARKNESS 10 HOURS
   - D. VISIBILITY 25 MILES
   - E. WIND

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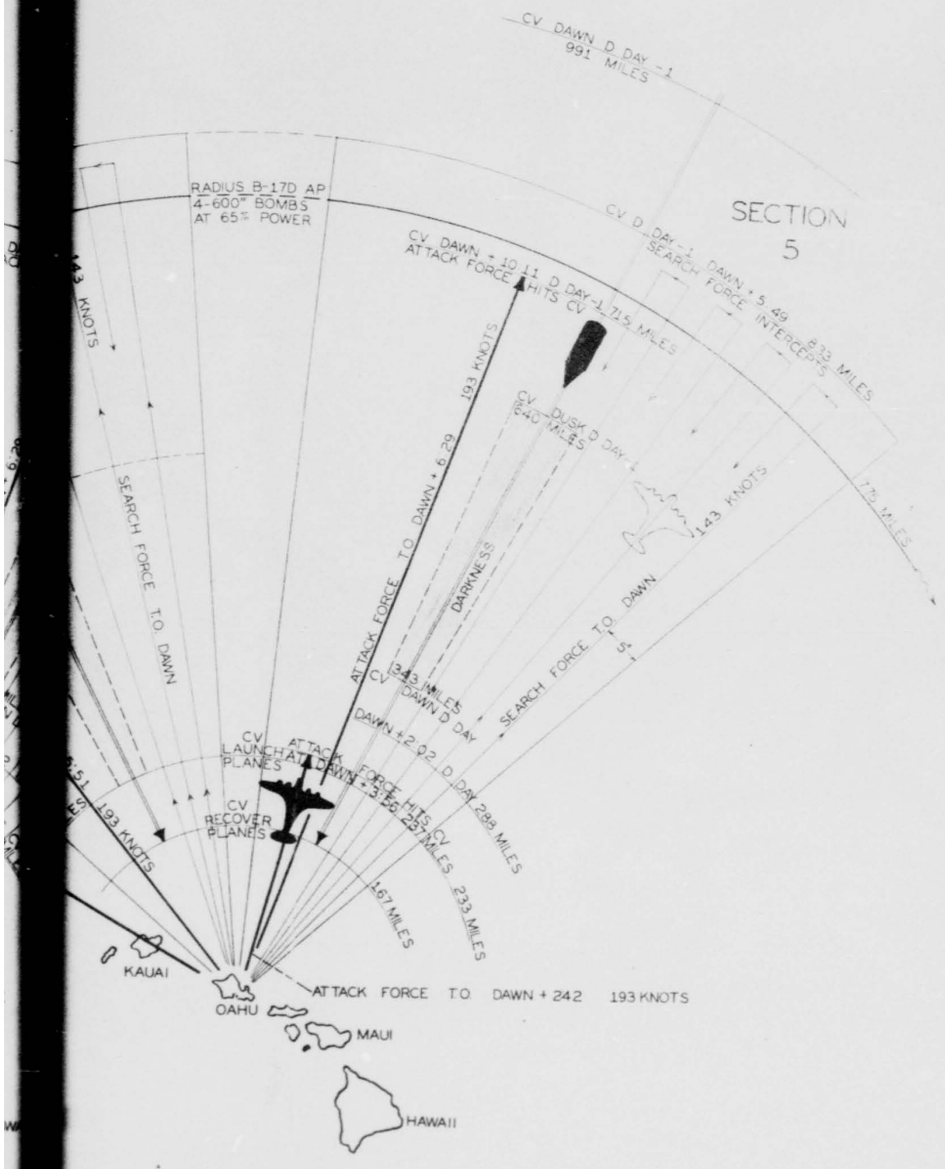

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1. RADIUS OF ACTION OF B-17D AIRPLANE UNDER VARIOUS CONDITIONS IN RELATION TO POSSIBLE PLANS OF ACTION OF A CARRIER GROUP ATTACKING OAHU.

2. MILES SHOWN ARE NAUTICAL MILES.

3. SECTIONS 5&6 INDICATE ONLY TWO OF MANY CONDITIONS THAT MIGHT OCCUR DURING A 360° SEARCH.

4. PERFORMANCE OF B-17D AIRPLANE FOR EACH RADIUS OF ACTION ALLOWANCE IS MADE FOR 1 HR. FULL THROTTLE OPERATION AND 2HR. RESERVE.
   - A. RADIUS OF SEARCH 1067 MILES
     2500 GAL. FUEL NO. BOMBS
     45% POWER OUT AND BACK
     4000 FEET ALTITUDE 145 KNOTS
   - B. RADIUS OF ATTACK FORCE 775 MILES
     2093 GAL. FUEL 4-600# BOMBS
     65% POWER OUT +5% BAC
     15000 FEET ALTITUDE 133 KNOTS
   - C. RADIUS WITH MAXIMUM BOMB LOAD 588 MILES
     1700 GAL. FUEL 8-600# BOMBS
     65% POWER OUT 45% BACK
     15000 FEET ALTITUDE 193 KNOTS

5. ASSUMPTIONS
   - A. CARRIER SPEED 27 KNOTS
   - B. CARRIER PLANES' PERFORMANCE
   - C. DAYLIGHT [illegible] HOURS DARKNESS [illegible]
   - D. VISIBILITY 25 MILES
   - E. NO WIND

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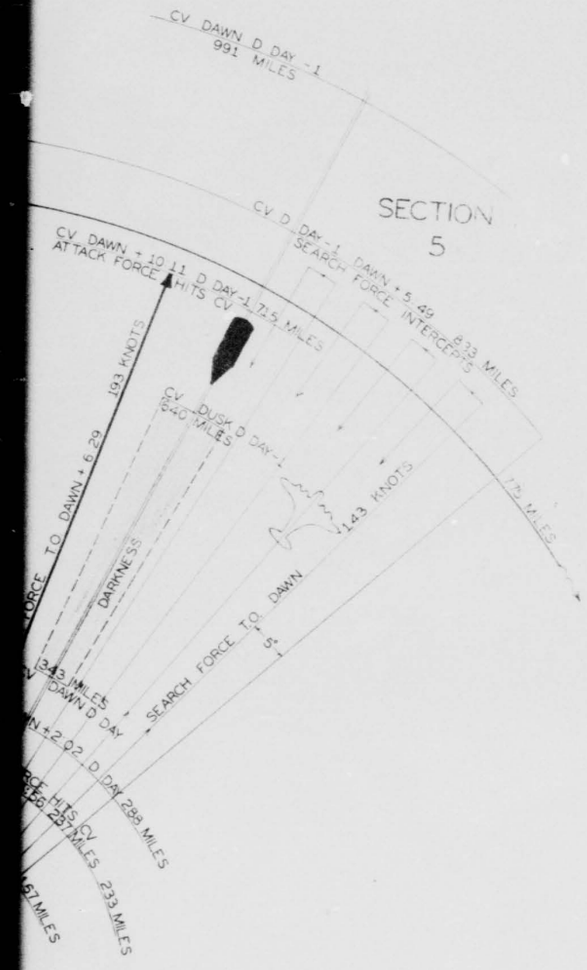

CHART 4

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OPERATING SCHEDULE FOR 216 B-17

DAYS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
SEARCH	AB	CD	EF	AB	CD	EF	AB	CD	EF	AB	CD	EF	AB	CD	EF	AB	CD
REST&TRNG.	CD	EF	AB	CD	EF	AB	CD	EF	AB	CD	EF	AB	CD	EF	AB	CD	EF
ALERT	EF	AB	CD	EF	AB	CD	EF	AB	CD	EF	AB	CD	EF	AB	CD	EF	AB

1. The 216 combat crews are divided into units of 36 each for the purpose of assignment to missions and are design

2. On the 1st day of operations, Groups A and B search, C and D conduct training and rest, F is on the alert for a attack mission if airplanes of the maintenance and reserve force are in commission. Thus it is planned that 72 combat c on the alert for an attack mission.

3. It will be noted that over a thirty day period each unit will:

   a. Fly a total of 10 search missions averaging 10 hours per mission, or 100 hours per period.
   b. Be on the alert for attack missions 10 days per period.
   c. Conduct training and rest 10 days per period.

OPERATING SCHEDULE FOR 288 B-17

DAYS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
SEARCH	AB	CD	EF	GH	AB	CD	EF	GH	AB	CD	EF	GH	AB	CD	EF	GH	AB
REST	GH	AB	CD	EF	GH	AB	CD	EF	GH	AB	CD	EF	GH	AB	CD	EF	GH
TRAINING	EF	GH	AB	CD	EF	GH	AB	CD	EF	GH	AB	CD	EF	GH	AB	CD	EF
ALERT	CD	EF	GH	AB	CD	EF	GH	AB	CD	EF	GH	AB	CD	EF	GH	AB	CD

1. The 288 combat crews are divided into units of 36 each for the purpose of assignment to missions and are design

2. On the 1st day of operations, groups A and B search, G and H rest, E and F conduct training, D is on the alert attack mission if airplanes of the reserve and maintenance force are in commission. Thus it is planned that 72 combat c be on the alert for an attack mission.

3. It will be noted that over a thirty day period units will average:

   a. 7½ search missions averaging 10 hours per mission, or 75 hours per period.
   b. 7½ days rest per period.
   c. 7½ days training per period.
   d. 7½ days on the alert for attack missions.

REMARKS

1. It should be noted that a minimum of 216 B-17 Combat Crews are considered necessary. Considerable doubt exists sustained operations. As has been pointed out, each combat crew will fly approximately 100 hours a month per 30 day peri Further it is possible that over an extended period of time combat crews may incur fire & round of service gun ammuniti training to maintain their combat efficiency. This training would be accomplished on the ten days set aside for rest. It is believed that combat crews, particularly pilots, could not perform continuous flying duty efficiently if required

2. The 288 combat crew schedule is, therefore, recommended as an alternative and it is suggested that sections of the Plan for the Employment of Redundant Aviation in the Defense of Cuba.

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FOR 216 B-17D COMBAT CREWS

	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	CD	EF	AB	CD	EF	AB	CD	EF	AB	CD	EF	AB	CD	EF	AB	CD	EF
	EF	AB	CD	EF	AB	CD	EF	AB	CD	EF	AB	CD	EF	AB	CD	EF	AB
	AB	CD	EF	AB	CD	EF	AB	CD	EF	AB	CD	EF	AB	CD	EF	AB	CD

o missions and are designated by the letters A to F inclusive.

, F is on the alert for an attack mission and the underscored group E is also on the alert for an
planned that 72 combat crews will search daily, 72 will conduct training and rest and 72 will be

er period.

FOR 288 B-17D COMBAT CREWS

	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	CD	EF	GH	AB	CD	EF	GH	AB	CD	EF	GH	AB	CD	EF	GH	AB	CD
	AB	CD	EF	GH	AB	CD	EF	GH	AB	CD	EF	GH	AB	CD	EF	GH	AB
	GH	AB	CD	EF	GH	AB	CD	EF	GH	AB	CD	EF	GH	AB	CD	EF	GH
	EF	GH	AB	CD	EF	GH	AB	CD	EF	GH	AB	CD	EF	GH	AB	CD	EF

missions and are designated by the letters A to H inclusive.

ning, D is on the alert for an attack mission and the underscored group C is also on the alert for an
planned that 72 combat crews will search daily, 72 will rest, 72 will conduct training, and 72 will

CHART 5

siderable doubt exists as to whether or not this number of combat crews are sufficient for
search per 30 day period and be on the alert for attack missions 10 days during the period.
f receive gun ammunition or bomber work. They must, therefore, conduct a certain amount of routine
e set aside for rest. It is not improbable that a pilot would fly some 100 hours per 30 day period.
efficiently if required to fly over 100 hours per month for any length of time.

gested that serious consideration be given to assigning this number of combat crews in furtherance

(C-242-917-17)(8-9-41)- CHART 5

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Frame Number	Classification Number	Date Period	Vol.	Pt.	Title	Security Classification	Remarks
4	145.4277	N.D			Cross City.	U	
20	145.511-E	1942			Aviation Cadets for Bombaedier,	U	
28	145.6111-1	Jun/44			Avignon & Adjacent Airdromes.	U	
36	145.619-1	Sep/45			AC/AS -5	U	
53	145.81	1942			Eastern Artic Survey.	U	
85	145.81-1	Dec/41			Estimate of Air Situations.	U	
95	145.81-2	Sep/41			↓	U	
114	145.81-3	Dec/41			Estimate of Air Situations.	U	
123	145.81-4	Sep/42			Cypress Plan.	U	
139	145.81-5	Nov/41			US Forces in Caribbean	U	
143	145.81-6	Nov/41			Activation of Greenland Base Command.	U	
148	145.81-7	Nov/41			Defense Project.	U	
154	145.81-8	Jan/42			Defense Project.	U	
162	145.81-9	Dec/41			Creation of Eastern Theater Operations.		
168	145.81-10	Jan/42			Air Defense.	U	
251	145.81-11	Nov/41			Brazil AAF Units	U	
270		N.D			Operation Plan NE Braizal.	U	
276	145.81-11	Jan/42			Strategic Importance.	U	

3825 FORM NOV 71 O - 23

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Frame Number	Classification Number	Date Period	Vol.	Pt.	Title	Security Classification	Remarks
299	145.81-12	Jan/42			Air Task Force.	U	
310	145.81-13	Feb/42			AAF for Minimun Security.	U	
334	145.81-14	Jul/41			Concentration Plan.	U	
407	145.81-14A	N.D			2nd AF Specifie Requirements.	U	
492	145.81-14B	Jul-Aug/41			Airdrome Report.	U	
512	145.81-15	Jul/43			Utility of Habbakuk.	U	
566	145.81-15A	Aug/43-Mar/44			Habbkuk llStudy.	U	
823	145.81-15B	Sep/43-Feb/44			Re Habbkuk.	U	
940	145.81-16	Jan-Mar/42			Hawaii-Aircraft Operation.	U	
952	145.81-16A	Oct-Dec/41			Hawaii-Memo for Gen.Tinker.	U	
963	145.81-16B	Dec/41			Hawaii-Memo for Mr. McCloy.	U	
973	145.81-17	Oct/42			Ferry Route by Col. Alva.	U	
980	145.81-17A	Jul-Aug/42			Col. Alva L. Harvey	U	
1063	145.81-17B	Oct/42			Distribution of Col. Harvey.	U	
1079	145.81-17C	Oct/42			Alaskan-Siberian Survey Flight.	U	
1114	145.81-17D	Ott/42			Col. Harveys Report.	U	
1127	145.81-18	Jun-Nov/41			Joint Board	U	
1149	145.81-19	Sep-Nov/41			Defense of Icelamd & Greeland.	U	

3825 FORM NOV 71 O-23

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DOCUMENT TO ROLL INDEX

Frame Number	Classification Number	Date Period	Vol.	Pt.	Title	Security Classification	Remarks
1182	145.81-20	Jan/42			Joint A-B Planning.	U	
1272	145.81-21	Sep/41			US- British Production.	U	
1348	145.81-22	Dec/42			Production of Combat Aircraft.	U	
1374	145.81-23	Sep/41			US-Production Requirements.	U	
1600	145.81-24	Aug/41			Joint Board Report.	U	
1615	145.81-25	1941-1942			Air Situation in Hawaii.	U	
1652	Index				Index		

3825 FORM NOV 71 O - 23

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